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GREATER YELLOWSTONE AREA

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GREATER YELLOWSTONE COORDINATING COMMITTEE

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The following is a summary of the Greater Yellowstone Area fires of the summer of 1988. Its origin dates back to September 16-17, 1988, when a special task force convened in West Yellowstone, Montana, to quickly gather information and prepare a report on the fire situation for anticipated Congressional Oversight Committee briefings and hearings.

It was used in what became known as its "Phase I" form to provide assistance and information to a variety of sources at a time when the primary effort was focused not on data collection, but on the fire fighting effort.

Since then, more detail has become available. Although the report's original purpose has been fulfilled, it is felt that the report, with updated information, would provide excellent reference material for land managers, fire experts, historians, and others.

This then--Greater Yellowstone Area Fire Situation, 1988--constitutes the final report. It contains information provided by each fire command and associated national forest and national park. However, it is not a fire review that analyzes management of each fire. Rather it is a compilation of facts and data.

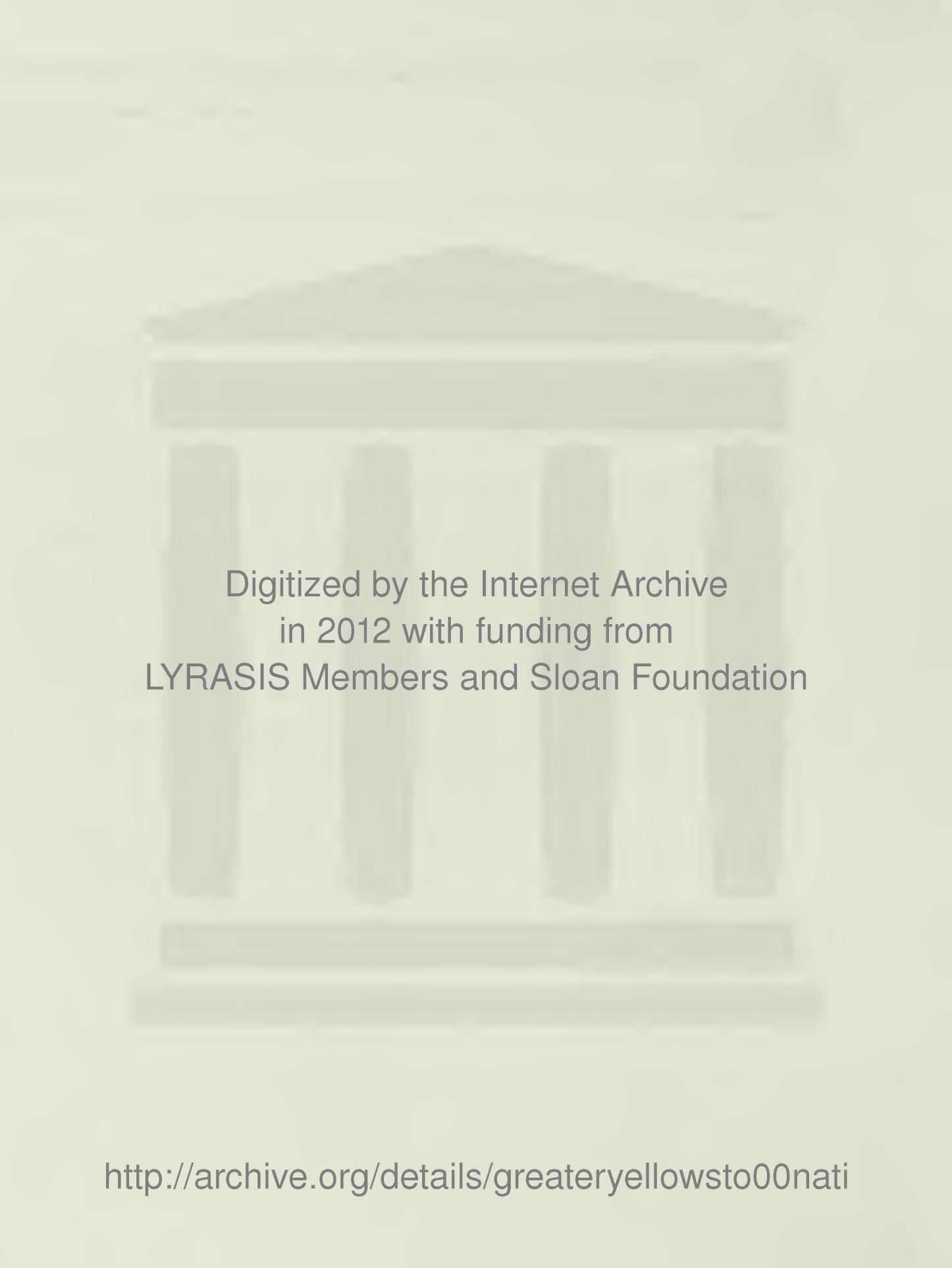
We accept this report for the Greater Yellowstone Coordinating Committee and thank those who have contributed to it, especially the task force and the researchers and writers who supported their efforts.

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ACKNOWLEDGMENTS

This report would not have been possible without the generous assistance of personnel in the two National Parks and the six National Forests that comprise the Greater Yellowstone Area. Persons too numerous to list individually provided records and data even when preoccupied with the overwhelming demands of the 1988 fire season.

In keeping with the traditions of firefighting, it took prodigious efforts of those involved in the research and writing of this final(Phase II) report to meet goals and deadlines. Those who worked on it were as follows:

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SUMMARY

The Greater Yellowstone Area (GYA) is made up of parts of six National Forests and two National Parks, totalling nearly 12 million acres, in northwest Wyoming, eastern Idaho, and south-central Montana. Management opportunities in the GYA are coordinated by the Greater Yellowstone Coordinating Committee, composed of three Regional Foresters, one Regional Director of the National Park Service, Forest Supervisors of six National Forests, and Superintendents of two National Parks.

Fire management policies of the Forest Service and the National Park Service components of the GYA are essentially similar. Two kinds of fires are recognized: wildfires, which are fires that require an immediate suppression response based on land management objectives, and prescribed fires, which are fires that are managed in accordance with a written plan, with frequent monitoring. A wildfire is any fire that does not contribute to land management objectives, a fire that threatens human life, property, or forest resources, or a fire that no longer meets criteria in the fire management plan. A prescribed fire may be started by lightning or by fire specialists wanting to accomplish certain land management objectives.

Each National Forest and National Park in the GYA has a plan that delineates tracts of land where fires will be suppressed and where prescribed fires will be managed under specific conditions. Such tracts are often Wilderness Areas, where natural forces, including fire, are allowed to play an ecological role in accordance with the definitions of the Wilderness Act of 1964. The fire management plans are coordinated among the units of the GYA, but there is much to be done to ensure that goals and suppression strategies are compatible, particularly along shared boundaries.

Fire history studies indicate that very large fires last occurred in the GYA in the 1800's. Since that time large tracts of lodgepole pine have reached late stages of succession, with heavy fuel loadings. A report issued in 1987 indicated that more than 50 percent of the GYA had moderate to high potential for high-intensity fires

While many parts of the United States were experiencing drought in early 1987, the GYA was in a mildly moist, cool period. September and October 1987, however, were record dry months with no precipitation recorded. By the end of December 1987, the GYA was in a mild drought. For the period 1951-1974, annual precipitation in the GYA averaged 15.87 inches. Between September 1987 and August 1988, precipitation was 9.81 inches, just 62 percent of the 1951-1974 average. Of the latter amount, 5.55 inches fell in April and May of 1988, twice the long-term average for these months. But from mid-May to mid-June the Palmer drought index readings went from severe to extreme. July and August were extremely dry, characterized by relative humidities below 20 percent and frequently falling below 6 percent. Various fire indices programmed with data from weather stations in the GYA indicate that fire danger ratings that usually do not develop until July and August were appearing in June and July of 1988.

During the summer of 1988, a high pressure area became fixed over the central Rockies. Temperatures remained above normal. A west-to-southwest atmospheric flow over northwest Wyoming kept precipitation from moving into the GYA from the Pacific. A series of dry lightning storms ignited fires in late May and June. Subsequent lightning and human-caused fires in July and August quickly grew to large size. The situation became so complex that priorities for firefighters and equipment had to be set. On July 23, an Area Command was established in West Yellowstone to coordinate suppression action.

A total of 249 fires occurred in the GYA in 1988. This was about twice the average for the area. Of the 249 fires, 31 were initially classified as prescribed fires: 28 in Yellowstone and 1 each in the Custer National Forest, the Bridger-Teton National Forest, and Grand Teton National Park. Of the 28 prescribed fires in Yellowstone National Park, 12 burned out at less than 1 acre, the remaining 16 later were declared wildfires and grew to large size despite intensive suppression efforts. Both prescribed fires on the National Forests were later declared wildfires, grew to large size, and burned into Yellowstone National Park. The prescribed fire in Grand Teton National Park burned out at less than 1 acre. Most fires in the GYA did not escape suppression efforts. Of the 249 fires, 201 (81 percent) were suppressed at less than 10 acres.

The combinations of low humidity, low fuel moisture, and strong gusting winds resulted in fire behavior that has not been seen in the Rocky Mountains on so large a scale since the notorious 1910 blowup. By mid-summer, moisture content of fine fuels was as low as 2 percent, with averages of 3 to 5 percent. Moisture content of large fuels was often as low as in the small fuels. The extremely low moisture in fuels of all sizes was the main reason fires burned fiercely both day and night and lofted burning embers up to 1-1/2 miles beyond the flaming front. At least six dry cold fronts crossed the GYA at 5 to 10-day intervals, each producing strong winds that gusted to 60 miles per hour. At such times fires made runs of up to 2 miles per hour through standing timber. Not until September 10th did a front bring cool temperatures and rain and snow, allowing fire fighters to line and mop up fires with consistent success.

At the outset, traditional perimeter control strategies using direct and indirect attack were attempted. But because of intense heat, rates of spread, heavy smoke, and long distance lofting of firebrands, this brought limited success. At one point, some 400 miles of fireline had been constructed, but only 20 miles could be held. This fact, and declining fire suppression resources, caused Area Command to shift priorities toward protecting lives and property. In some instances new ignitions were not suppressed because fire crews and equipment were not available, or because of concern for firefighter safety, or because the new ignitions would soon burn into existing fires. Many of the fires in the GYA burned in Wilderness Areas and thus required special precaution to avoid undesirable disturbance. Power saws and helicopters were used without restriction. Use of dozers was approved on an as-needed basis. "Light-on-the-land" tactics

were employed in setting up spike camps, building firelines, and felling trees.

Due to depletion of organized fire crews, Boise Interagency Fire Center requested assistance from the Department of Defense. On September 17, military assistance peaked with 4,146 soldiers, marines, sailors, and airmen. Four Army and two Marine battalions comprised the bulk of the task force. In addition, the DoD provided massive air support: helicopters for ferrying firefighters and supplies, fixed-wing aircraft equipped for infrared detection and mapping, and cargo and troop transports. The Wyoming National Guard also provided air and ground support on several fires.

Protecting lives and property became top priority in the GYA during the 1988 fire season. No injuries to the public were sustained during burnovers of campgrounds, private homes, or Park facilities. In the GYA, losses to fire were 3 residences, 13 mobilehomes, 10 private cabins, 2 Forest Service cabins, 1 National Park Service cabin, 18 cabins leased to or owned by a concessionaire, 2 Park dormitory rooms, 6 private outbuildings, 2 Forest Service bridges, miscellaneous fire crew personal gear, and phone lines and power lines within the Park. Many more structures were saved by fire crews. For example, of 400 structures at Old Faithful, only 20 were damaged or destroyed.

Considering that suppression continued more than three months with a peak of 9,500 firefighters and 117 aircraft, there were remarkably few serious injuries or deaths. A pilot was killed in a plane crash while landing at Jackson, WY, after transporting fire personnel. A Bell helicopter crashed while filling a water bucket at a lake; the pilot escaped with minor injuries. There were no fireline fatalities or serious injuries on the GYA fires prior to October. In the second week of October, one firefighter was killed and one critically injured by falling snags while working on mop up.

Several spike camps were overrun by fires and in several instances firefighters deployed fire shelters. Respiratory problems such as flu, bronchitis, and strep throat became commonplace as crews were exposed to dense smoke, dust, and cold night temperatures. Firefighters had a few minor encounters with grizzly bears.

At the time of this report, the area within the fire perimeters was an estimated 1.4 million acres. Of this amount, about 900,000 acres lie within the Yellowstone National Park. An estimated 30 to 50 percent of the area within the fire perimeters remained un-burned, producing a vast mosaic of various burn intensities and unburned vegetation.

Shortly after fires passed, new vegetation was observed sprouting through the ashes in some locations. Biologists predict that by the third growing season 70 percent of the forest floor on the gentler slopes should be covered by plants. Fireweed, lupine, geranium, grasses, elk sedge, and 20 other species are expected to appear. Shrub species such as willow, silver sagebrush, bitterbrush, and ceanothus can be expected after fire in northwest Wyoming. Lodgepole pine releases seed and quickly becomes reestablished following fire if there is an adequate seed source nearby.

Lodgepole pine seedlings should carpet significant portions of the ground within 10 years.

Severe damage to several steep watersheds of the Shoshone National Forest could occur and may occur for years to come if high intensity storms were to take place. Sedimentation would be significant in these areas and may cause severe damage downstream.

Elk, deer, and bison were killed by the fire but the numbers were not significant reductions in terms of total populations. Loss of winter range may pose problems in the coming winter. Several fish kills were reported; lethal factors are suspected to be changes in water chemistry due to deposition of ash, a rise in water temperature, or both.

Monitoring of air quality revealed that standards for total suspended particulate were exceeded on many occasions at Mammoth, Gardiner, and West Yellowstone. Protective measures were recommended, particularly for those with respiratory problems.

Numerous post-fire studies and rehabilitation activities are underway. Fire crews and maintenance personnel are cleaning up disturbance created by fire and firefighting. Other rehabilitation programs are in the planning stages. Teams of Forest Service and National Park Service personnel will review various aspects of the 1988 fire season in the western United States.

INTRODUCTION

REPORT ORIGINS AND PURPOSES

This report had its origins in mid-August when Area Commanders Rick Gale and Dick Cox recognized the need for recording events of the Greater Yellowstone Area (GYA) fire situation and management actions. As this unprecedented fire season unfolded, intense political, public, and media attention focused on the Area, and it became even more important to document events.

On September 16-17, a special task force convened in West Yellowstone, MT, to prepare a report on the fire situation for anticipated Congressional Oversight Committee briefings and hearings. This became known as Phase I, and staff working on the original report diverted to provide assistance and information. The Phase I (completed September 28) described agency fire management policies, the overview of the fire situation, and post-fire activities. Phase II (the report that started in mid-August) was to continue under the auspices of the special task force. It provides more detail with descriptions of policies, fire management plans, 1988 fire environment and fire occurrence, detailed fire chronologies, suppression strategies, military support, protection of life and property, fire effects, air quality, public information, and post-fire programs. Much of this document was prepared from fireline information obtained from each Incident Command Post and associated National Forests and National Parks. In addition, publications, reports, plans, and personal communications provided details for sections about fire management plans, fire behavior and weather, and fire suppression actions, fire effects, and air quality.

SCOPE AND CONTENT OF REPORT

The purposes of Phase II are stated below:

- Describe current fire management policies of the National Park Service, U.S. Department of Interior, and the Forest Service, U.S. Department of Agriculture.
- Provide an overview of fire management plans for each National Forest and National Park on the Greater Yellowstone GYA.
- Describe the 1988 fire environment and fire occurrence.
- Provide daily chronologies for each of the 10 major fires.

Phase II is intended as an objective account of the Greater Yellowstone Area fires and is prepared primarily for the Regional Foresters, Regional Director, Forest Supervisors, and Park Superintendents and their staffs, who have overall responsibility for managing National Parks and National Forests. This report should also prove useful as a reference document for post-fire programs, and other future activities.

The research and writing of this report was accomplished during the period August 22 to October 15. With the phasing out of Area Command in West Yellowstone, certain documents such as daily updates of the fire situation, infrared mapping, and so on were no longer available after mid-September and thus are not carried in the report.

Readers are forewarned that this is not a fire review--a document that makes judgements about the management of a specific fire. Such investigation was not part of the Task Force's assignment and is not part of the Phase II report.

SECTION 1: GREATER YELLOWSTONE AREA

DESCRIPTION OF AREA

The Greater Yellowstone Area is made up of all or parts of six National Forests and two National Parks. The contiguous portions of these Parks, National Wildlife Refuges, Forests, unreserved public domain (Bureau of Land Management) Lands encompass roughly 11.7 million acres of Federal reservations, plus State and other lands. The Greater Yellowstone Area (GYA) is located primarily in northwest Wyoming and incorporates adjacent lands in eastern Idaho and southcentral Montana. It includes all or part of 12 counties. (fig. 1)

The GYA is world renowned for its scenery, wildlife, wilderness, rivers, hunting, fishing, outdoor recreation opportunities, and geologic and thermal features. Other resources, although not as well known, are critically important to the people living in and adjacent to this vast area. Activities such as timber harvesting, firewood gathering, livestock grazing, mining, oil and gas development, outfitting, and tourism associated with recreation are important segments of local economies.

Park Service and Forest Service managers have met regularly and informally over the past three decades to ensure coordination of management and public service. They coordinate such resources and activities as

- roads, trails, and recreation development;
- waste disposal;
- wildlife and fisheries needs;
- outfitter and guide provisions;
- fire control and management; and
- overall public needs.

The concept of formalized interagency coordination grew from concern expressed by some segments of the public during the past few years that National Park and National Forest management in the GYA was not as well coordinated as it should have been. Some feared that direction in management plans for the National Park Service and Forest Service did not take into account the cumulative effects of activities on the unique natural resources. Others were concerned that because of the differing management objectives for Forests and Parks, some important aspects of the area as a whole would suffer irreparable damage.

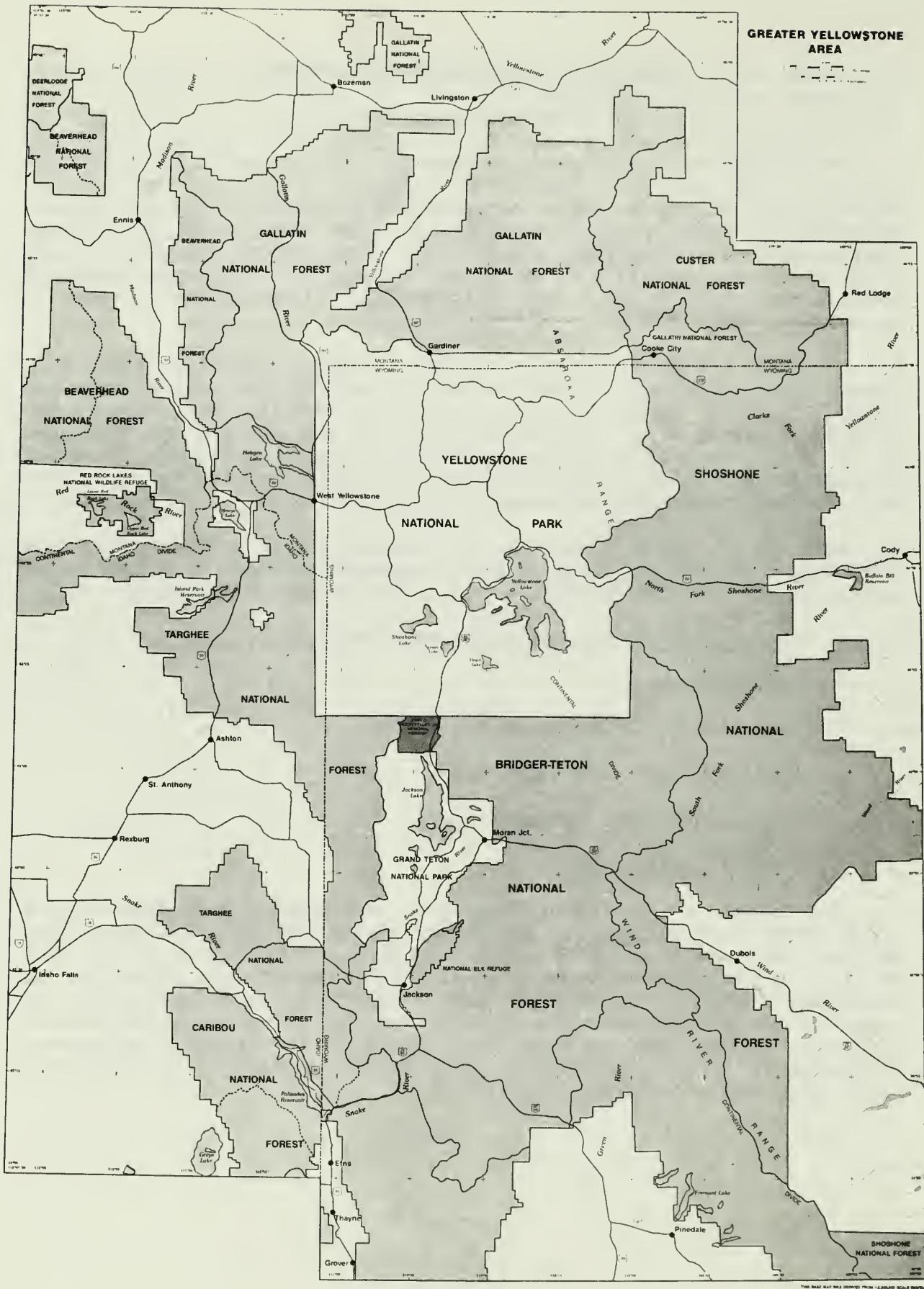


Figure 1. Six National Forests and two National Parks comprising the Greater Yellowstone Area.

GREATER YELLOWSTONE COORDINATING COMMITTEE

In the early 1960's, Forest Service and National Park Service managers recognized the need for coordination in managing Forests and Parks and formed the Greater Yellowstone Coordinating Committee. Congress has shown great interest in the Greater Yellowstone Area and has held hearings on the management of the area. A memorandum of understanding was signed in September 1986 for documenting existing cooperative relations. The Greater Yellowstone Coordinating Committee (GYCC) is composed of the following members:

- Regional Foresters of the Intermountain, Northern, and Rocky Mountain Regions of the U.S. Forest Service
- Regional Director of the Rocky Mountain Region of the National Park Service
- Forest Supervisors of the Beaverhead, Custer, Gallatin, Shoshone, Targhee, and Bridger-Teton National Forests
- Superintendents of Grand Teton and Yellowstone National Parks

The managers meet twice each year to discuss issues and to agree on ways to improve coordination. The GYCC does not impose decisions, rather it helps identify and resolve any communication gaps between Parks and Forests.

In September 1987, the GYCC released The Greater Yellowstone Area: An Aggregation of National Park and National Forest Management Plans, which is a summary of existing Forest and Park management plans displaying the condition and extent of resources and management activities. An interagency team leader position, under the direction of the GYCC, was established and located in Billings, MT. The following administrative units are included within the GYCC:

- Madison Ranger District of the Beaverhead National Forest
- Western portion of the Beartooth Ranger District of the Custer National Forest
- Gallatin National Forest south of Interstate 90
- Shoshone National Forest, except for the Lander Ranger District
- Bridger-Teton National Forest except for the Kemmerer Ranger District and the southern portions of the Big Piney and Pinedale Ranger Districts
- Targhee National Forest, except for the Dubois Ranger District
- The portion of the Caribou National Forest administered by the Targhee

- Yellowstone National Park
- Grand Teton National Park, including the John D. Rockefeller Jr., Memorial Parkway

INTERAGENCY FIRE MANAGEMENT

Historically, fires occurred in the Greater Yellowstone Area and influenced the evolution of the existing flora and fauna. As a result, some species are dependent on periodic fires for their very existence and all have adapted to this ecological factor. In addition, fires influence characteristics of soil, air, and water resources. Most of the area is considered to have moderate potential for high-intensity fire. In the 1800's, extensive areas burned, creating the present vast stands of lodgepole pine.

Due to increased development in past decades and specified land and resource values, land management agencies have designed strategies to manage fires. Fires are categorized as either wildfires or prescribed fires, and management actions for each are quite different.

Wildfires are any fires not designated and managed as a prescribed fire within an approved prescription. They can be the result of lightning, human carelessness, or escaped prescribed fires. Suppression strategies are confine, contain, and control. Prescribed fires, on the other hand, are those that are burning under preplanned conditions and that are expected to accomplish land management objectives. Such fires can be the result of lightning or planned ignition.

Fire management is one of the coordinated activities within the GYA. The opportunities for joint planning and compatible actions are:

- Ensure that each unit's fire suppression strategies are compatible with management objectives of adjacent units.
- Ensure that fire suppression strategies on any one unit do not present undue risk of fire to resources of other units.
- Manage prescribed fire and fire suppression so that smoke is at an acceptable level and meets State air quality standards.

Each Forest and Park has a plan that delineates certain tracts of land where all fires will be suppressed and other areas where prescribed fires may be used within predetermined prescribed conditions. (Overviews of these plans are presented in Sections 2 and 3). As a consequence, in selected areas of adjacent units the two agencies have the option to allow prescribed fires to move across boundaries. Along other shared boundaries, suppression is necessary because of differing land uses, ignition source, or exceeded prescription.

UNIFIED AREA COMMAND FOR 1988

When several prescribed fires in the GYA exceeded prescription criteria during July 1988, the decision was made to handle them as wildfires. Due to the numerous fires and the complex situation, the GYCC established the Unified Area Command on July 23. This decision, which illustrates effective interagency coordination within the GYA, followed a thorough review of the situation by National Park and National Forest managers. Previously, individual Parks and Forests managed each fire.

The Unified Area Command was a joint National Park Service and Forest Service action staffed by Fire Command Officers from both agencies. In addition to setting priorities on allocation of forces to ongoing fires, the Unified Area Commanders coordinated with Greater Yellowstone managers in developing fire management suppression strategies for all wildfires within the area of responsibility.

Park Superintendents and Forest Supervisors set the following objectives for the Area Commanders:

- Safety is the first priority.
- Protect life and property.
- Protect cultural values.
- Keep the local public, visitors, media, and cooperators/informed.

The first Area Commanders were Troy Kurth (USFS) and Bill Pierce (NPS), who held the positions from July 23 to August 13. Figure 2 shows the final fire perimeters within the GYA under the unified command.

Kurth held the Forest Service position until August 5 when he was replaced by Mike Edrington, who stayed until August 12. Edrington was replaced by Dick Cox, who stayed until August 27. Ken Ditmer followed and stayed until September 25. For the National Park Service position, Rick Gale replaced Pierce on August 12 and stayed until September 29. Each transition included a 2-day overlap. Area Command ended on September 29.

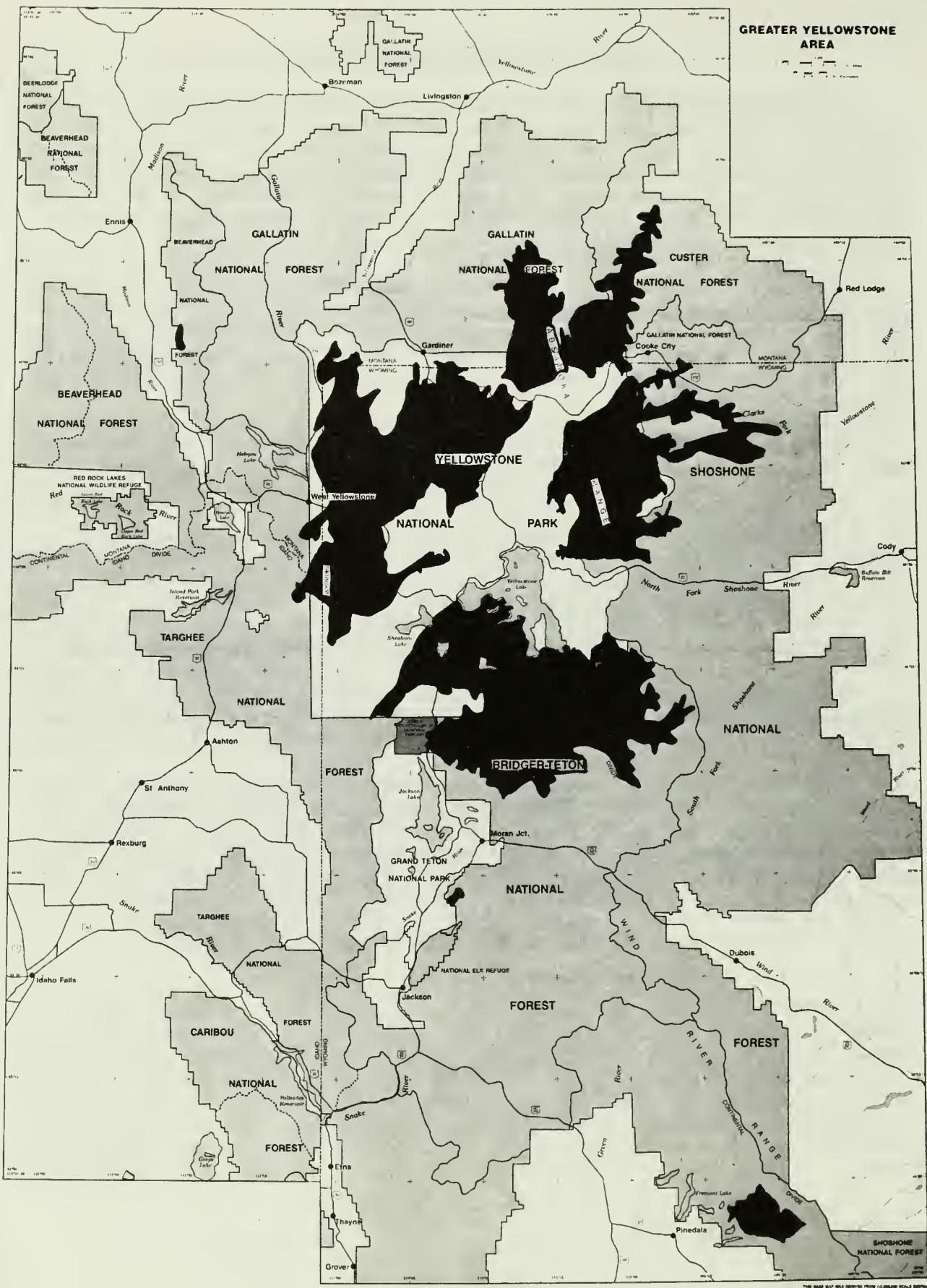


Figure 2. Perimeters of major fires managed by Area Command.

SECTION 2: NATIONAL PARK SERVICE MISSION AND FIRE MANAGEMENT POLICY

MISSION

National Parks were founded to perpetuate natural conditions and processes and to foster their public endowment, as specified by congressional mandate.

National Parks, for the most part, are withdrawn from mineral development. Timber harvesting is not permitted, and watershed and wildlife habitat modification projects are generally not undertaken. Some livestock grazing and hunting is allowed in Grand Teton National Park, but these activities are strictly limited in scope and location. National Parks are also subject to the provisions of the 1964 Wilderness Act, and although no congressionally designated wilderness exists in Yellowstone or Grand Teton National Parks, large areas are recommended and managed as wilderness.

POLICY

Between 1916 and 1968, Park Service policy was to strictly suppress wildfire and to eschew the use of prescribed fire. Although not officially adopted, the Forest Service's so-called "10 a.m. Policy" was adhered to; fires should be suppressed by 10 a.m. of the morning following discovery.

This policy began to change in the 1950's when controlled burning was used in Everglades National Park to maintain open glades and piney woods mainly for wildlife habitat.

The fact that the absence of fire or other natural disturbance would initiate successional changes in some plant communities became widely accepted by 1960. This point was especially prominent in the 1963 Leopold Report (although the mandate of that panel was to examine issues related to wildlife management). The Leopold Report, which was adopted by then Interior Secretary Udall as official policy, emphasized the importance of understanding "natural or man-caused process of ecological succession" in managing ecosystems. In response to that report, as well as other research findings, Park Service policy toward fire was dramatically changed in 1968. Fires of natural origin were recognized as "natural phenomena" and prescribed burning was accepted as a means of achieving resource objectives.

In the years immediately following 1968, Park Service fire policy permitted considerable innovation. In 1978, NPS-18 Fire Management Guidelines became the first codified instructions for National Park fire programs. Fire policy in Parks was tied to Park-specific management objectives. Biological, ecological, and physical problems are the central concerns of NPS-18. Human considerations are limited to minimizing resource damage resulting from fire suppression activities and to liability for air quality, human safety, and property protection.

Current policy recognizes that natural disturbances do not occur with precise regularity, and the perpetuation of dynamic fire-adapted ecosystems requires allowing a full range of fire effects to occur.

Wildland fire management encompasses four broad activities: prevention, presuppression, suppression, and prescribed fire. The paramount considerations are 1) protection of life, 2) protection of facilities and cultural resources, and 3) perpetuation of natural resources and their associated processes. Because of the diversity of Parks, no one program fits all. The wildland fire management program must be appropriate for the purpose and resources of each specific Park.

All fires in Parks are classified as either wildfires or prescribed fires, depending on whether a fire is counter to management objectives (wildfire) or contributes to management objectives (prescribed fire).

The National Park Service policy states that wildfires are to be considered emergencies and suppression will be given highest priority. Initial attack will be carried out to minimize cost and damages and to prevent fire escape. An escaped fire situation analysis (EFSA) will be prepared when a fire escapes initial action. The EFSA must consider suppression costs, values at risk, firefighter and public safety, and environmental, cultural, social, and political concerns. Suppression strategies include confinement, containment, and control. Suppression methods should be those causing the least resource damage commensurate with effective suppression.

Prescribed fire includes 1) prescribed burns, which are ignitions deliberately carried out by employees, and 2) prescribed natural fire, which are ignitions started by lightning or volcanoes. If prescribed fires exceed prescriptions, they are considered wildfires and will be handled with the appropriate suppression response. An EFSA or fire situation analysis (FSA) will be prepared for prescribed natural fires initially and updated either daily or as the situation changes.

The fire management plan is the key document for carrying out a comprehensive fire program and must be designed specifically for Park objectives. These plans provide for suppression actions and prescribed fire, including ignitions by both employees and natural agents. Plans are written by the Park specialists, reviewed by the Regional Office, reviewed for policy compliance and technical completeness by the Washington Office, and then approved by the Regional Director.

FIRE MANAGEMENT PROGRAMS FOR NATIONAL PARKS

Yellowstone National Park

Yellowstone National Park's original Fire Management Plan was created in 1972 as a response to the Leopold Report, which became embodied as policy guidelines in 1968 for administration of natural resources. Prescribed fire was encouraged via planned and/or unplanned ignitions in natural areas where it was an ecological factor. Yellowstone's fire plan designated two remote regions of the Park as a natural fire zone.

A 1975 revision was prepared following an environmental assessment and public review. This revision expanded the program by placing the entire Park in a natural fire zone with exclusion of certain developments where human safety and property were important considerations. Suppression zones were also established on shared boundaries with the surrounding National Forests where management directives differed. Eventually, much of the adjacent forest land became designated as wilderness, so interagency agreements were prepared by which the Park and Forests could jointly manage fires that could cross mutual boundaries. A 1987 revision of the plan, currently under review, incorporated the experience gained from the management of prescribed natural fires.

In accordance with the policy of the National Park Service and with the special mandates of Yellowstone National Park, the objectives of wildland fire management as stated in the 1987 revision are:

- Permit as many lightning-caused fires as possible to burn under natural conditions.
- Protect from wildfire human life, property, historic and cultural sites, special natural features, endangered species where management goals do not allow prescribed natural fire.
- Suppress wildfire in as safe, cost-effective, and environmentally sensitive a way as possible.
- Resort to prescribed burning, when and where it is necessary, and to reduce hazard fuels by safe, cost-effective, and environmentally sensitive means.

To facilitate fire management, the Park has defined three Fire Management Areas (FMA). The Park at large is the Yellowstone FMA. Withdrawn from the Park at large are two more FMA's. The Boundary FMA is the Park boundary interfaced with private and public lands where management of fire gives special consideration to adjacent land values. The boundary FMA functions as a transition zone between the fire program of the Park and its surrounding neighbors, that may allow joint prescribed fires or require suppression. The Village FMA includes the vicinity around each developed site that requires fire protection. Maximum effort will be made to suppress unwanted fires. Prescribed burning or mechanical hazardous fuel removal may be done to reduce wildfire threats.

Since the implementation of the Yellowstone Fire Management Plan in 1972 up through 1987, 235 prescribed natural fires occurred. Of these, 201 were one acre or less in size, and 13 were greater than 500 acres. From August 1972 through November 1987, total acreage of prescribed natural fires was 34,463.

Yellowstone shows a pattern of fire behavior and fire frequency that is peculiarly dependent on the character of its fuel complexes, its seasonal winds, and its ignition sources. In general, most natural burning is the product of a fractionally small number of fires that become large, and these large fires form extensive burning complexes during unusually dry seasons. The distribution of fire seasons is episodic, and fires tend either to burn very small areas or to evolve into high-intensity crown fires.

The fuel types fall into three classifications: One complex consisting of old-growth lodgepole pine, Engelmann spruce and subalpine fir; one of young to middle-aged lodgepole pine; and one of sagebrush and scattered Douglas-fir. Wet meadows, alpine tundra, stands of whitebark pine, aspen groves, sites disturbed by human settlement, and other biotic features are locally significant. Fuel types vary according to soils and precipitation. Soils derived from Absaroka volcanics and Yellowstone volcanics, over which passed a succession of Pleistocene glaciations. Lodgepole pine favors Yellowstone volcanic soil and drier sites. Douglas-fir, or steppe, habitat appears on glacial till, limestone of the Yellowstone-Lamar River valleys, and recent lake sediments at generally drier sites.

Lodgepole pine occupies about 80 percent of the forested cover of the Park. In most places, it gives way to spruce-fir, but because of slow growing conditions and past fire history it occurs in pure stands, locally supplemented by whitebark pine. Fire behavior properties tend to be controlled by the more or less regular succession of fuel properties of lodgepole pine as it undergoes stand evolution. The history of large fires conforms closely to stand ages that can support surface fire leading to crown fire.

For purposes of fuel typing, five categories of lodgepole pine are recognized and mapped for Yellowstone. The bulk of the extreme fire behavior occurs in the LP4 type. This type is predominately overmature lodgepole pine and contains some Engelmann spruce, subalpine fir and whitebark pine in the pole-sized class. The LP4 is characterized by a ragged canopy of scattered snags and lodgepole pine in the old-growth successional stage and an understory of small-to-large Engelmann spruce and subalpine fir seedlings and saplings. The LP3 is overmature lodgepole forming a broken canopy and having an understory of lodgepole pine and/or whitebark pine. The LP2 is a cover which consists of small-to-medium Engelmann spruce and fir or predominately lodgepole pine. The LP1 is a closed canopy of even-aged, usually dense lodgepole pine where trees are younger and shorter than those of neighboring stands. The LP0 is a recently burned or harvested lodgepole pine stand in the grass to seedling/sapling stage before canopy closure.

For fire-danger rating, NFDRS Fuel Model H is appropriate for lodgepole pine stands. For fire behavior forecasting, NFFL fuel model 8 typifies lodgepole stands for most of their lifetime. Where understories of conifer reproduction, usually spruce-fir are present, NFFL fuel models 6 or 7 may be more suitable, perhaps in combination with fuel model 8. No fuel model yet exists for crown fuels or crown fire behavior. Experience shows, however, that surface fire intensities of particular magnitudes are necessary to sustain crown fire behavior, and the use of the above fuel models will characterize situations in which crown fire may be expected if the ambient wind speed is of sufficient velocity.

For mature spruce-fir Forests, the appropriate NFDRS Fuel Model is G. The best NFFL model is 10. Where a dense understory of spruce-fir invades mature lodgepole pine, the use of NFFL model 6 or 7 may better characterize fire spread, with appropriate adjustments for reduced wind speed due to the lodgepole canopy.

To generate large fires, a surface fire must spread into the crowns, and the canopy must be sufficiently dense and closed to sustain crown burning. These conditions demand not only drought, but adequate ladder fuels for a surface fire to spread into the crowns. For the most part, such circumstances only occur when old-growth lodgepole pine stands are succeding to spruce-fir or to substantial expanses of lodgepole pine reproduction. The self-pruning properties of lodgepole pine, which segregate surface from aerial fuels, demand an independent source of ladder fuels. This is supplied by spruce-fir reproduction, the critical component of the entire fuel complex.

The principal components of the steppe fuel complex are big sagebrush and Idaho fescue. Douglas-fir and aspen form stringers and stands within and around the perimeter of the complex. The density of these stands varies by site. In places, other species--lodgepole, spruce, and subalpine fir--are interspersed with Douglas-fir and may succeed it. The principle fuels are sagebrush, with conifer and aspen groves as interspersed clusters. The typical pattern for fire in steppes is to begin in an isolated stand of Douglas fir, then simply burn out without carrying into the sagebrush and green grass. As a single complex, these fuels are best characterized by coherent stands of significant dimensions. NFFL Fuel Model 8 may be used to characterize the enclaves, and where reproduction is important, NFFL Fuel Model 6.

Grand Teton National Park

Grand Teton National Park has recognized fire as a natural phenomenon that must continue to influence ecosystems if truly natural areas are to be perpetuated. In 1972 a Fire/Vegetation Plan was approved and implemented, which allowed lightning-caused fires to burn under certain conditions. It identified the use of prescribed fire to restore fire as a natural ecosystem element in selected areas.

Since the implementation of the 1972 plan, the Park has had 4 major fires (1,000-3,500 acres). A significant revision of the Fire Management Plan was completed in June 1988. The goals of the current Grand Teton National Park Fire Management Plan are:

- Allow fire to achieve its natural role.
- Use fire to accomplish resource management objectives.
- Protect life, property, and resource from unwanted fire.
- Avoid unacceptable effects of fire and fire suppression.

For purposes of fire management the Park is divided into three prescription zones: Zone 1 - Prescribed Natural Fire Zone, Zone 2 - Conditional Fire Management Zone, and Zone 3 - Fire Suppression Zone. Each zone has a unique set of fire management objectives.

In Zone 1, all lightning-caused fires will be allowed to burn throughout the year and under almost all weather conditions, if they satisfy prescription criteria contained in a decision flow chart. A portion or all of a fire will be suppressed if it threatens: human life, private property, private or retained use and occupancy sites, major park developed areas, developed campsites and day-use sites, trailheads, cultural or archaeological resources, endangered or threatened species, to escape from the management zone, to violate air pollution control laws and regulations, or to negatively impact other resource management objectives. Fires from Zone 2 and 3 may be managed to burn into Zone 1.

The conditional fire management in Zone 2 attempts to strike a balance between restoring and perpetuating fire-dependent ecosystems and protecting life and property within and beyond park boundaries. Conditional zones are located where there is the greatest risk of fire escaping beyond Park boundaries. Prescribed fire (prescribed burning and prescribed natural fires) will be allowed within a pre-determined set of parameters, including potential to escape the zone, existing and forecasted fire weather and behavior, smoke management constraints, and availability of equipment and personnel. When conditions are not within these parameters, fires will be suppressed (confined, contained, controlled, or a combination). In the conditional zone, prescribed fires will be allowed to burn only if they satisfy prescription criteria in both a flow chart and a table of weather, fuel moisture, and fire behavior parameters. A prescribed burning program

will be implemented within conditional fire zones to encourage regeneration of native plant species and to reestablish a natural mosaic of climax, sub-climax, and seral plant communities.

Zone 3 is designated fire suppression to provide intensive protection for human life and property within and outside park boundaries. All lightning and human-caused wildfires originating from within or that threaten a fire suppression zone from outside will be suppressed (confined, contained, controlled, or a combination). Hazardous fuel reduction will be done. Prescribed burns intended for hazardous fuel reduction must satisfy very specific prescriptions, which include acceptable ranges of temperature, relative humidity, wind speed and direction, fuel moisture, fire danger indices, fire behavior parameters, and air quality/smoke conditions.

Since the implementation of the Teton Fire Management Plan in 1972 up through 1987, 156 fires have burned over 9,100 acres, mostly as the result of single, large, lightning-caused fires (3,500 acres in 1974; 2,000 acres in 1981; 1,028 acres in 1985; and 2,350 acres in 1987). Since 1972, 51 percent of the fires have been man-caused and have remained under a full-suppression management strategy.

Broad types of vegetation include sagebrush-grasslands (22 percent of the terrestrial area); lodgepole pine and Douglas-fir forests (24 percent); riparian vegetation (8 percent); and subalpine forest, unvegetated rocks, and other substrates (46 percent). Over 200 species of fungi and 921 species of vascular plants occur in the Park or nearby Teton County, WY.

Forested areas are a mixture of limber pine, lodgepole pine, whitebark pine, Engelmann spruce, subalpine fir, and Douglas-fir. Scattered patches of aspen are found at lower elevations. Cottonwood, willow, and Colorado blue spruce line the Snake River and its tributaries, and big sagebrush dominates the valley floor.

Wildland fuel loadings in the Park are diverse and depend on cover type and the age of a given stand. In the National Fire Danger Rating System, 31 percent of Park area is classified as fuel model G (mixed conifer-heavy dead).

Grand Teton National Park's vegetative cover is a dynamic network affected by many environmental factors, including fire. Some areas are influenced little by fires; in others, fire has been a major factor in determining vegetative cover and species composition. In pristine times, recurrent fire maintained a large percentage of the vegetation in early stages of succession, perpetuating aspen and lodgepole pine over extensive areas. Diversity was maintained through the presence of different age classes of stands. The diversity of communities forms a large-scale mosaic and contributes to ecological stability of the entire network.

SECTION 3: U.S. FOREST SERVICE MISSION AND FIRE MANAGEMENT POLICY

MISSION

Through legislation, Congress has mandated that the National Forests be managed for multiple uses of outdoor recreation, wildlife and fish, range, minerals, watershed, timber, and wilderness.

A large acreage of congressionally designated Wilderness exists within National Forests. Such areas are managed in accordance with the 1964 Wilderness Act and thus are not available for the full range of multiple uses.

POLICY

In 1935, the Forest Service implemented the 10 a.m. Fire Suppression Policy. The principal objective was to control all fires before 10 a.m. (the start of the most active burning period) on the day following discovery of the fire. In 1978, the policy was revised to allow more comprehensive fire management. Certain fires started by lightning in Wilderness and other selected areas would be allowed to burn while being carefully monitored. The new policy was designed to be more responsive to land and resource management objectives, firefighter and public safety, and environmental, social, and political concerns.

On National Forest lands, fires are designated as either wildfires or prescribed fires. A wildfire is any fire in wildlands or developed areas not designated and managed as a prescribed fire. A prescribed fire is any fire burning under preplanned, specified conditions to accomplish particular planned objectives. It may result from either a natural ignition (lightning) or be ignited by fire managers.

Forest Service policy is to suppress wildfires in a timely, energetic, and thorough manner, with a high regard for public and firefighter safety. Every wildfire requires an appropriate suppression response with available forces based upon fire management plans and cost efficiency. Responses range from prompt control, minimizing acreage burned, to fire containment and confinement when these alternatives are less costly than control.

Initial attack is aimed at minimizing firefighting cost and damages and to prevent escape of the wildfire. If a wildfire escapes initial attack, an Escaped Fire Situation Analysis is prepared in order to assess the most appropriate action. Potential suppression costs, values at risk, firefighter and public safety, environmental, cultural, social, and political concerns are evaluated. Subsequent EFSAs are prepared as necessary.

Fire plans are prepared in advance of all prescribed fires. Personnel conducting fires must meet training and qualification requirements. If a prescribed fire exceeds prescription and cannot be brought back into prescription with project funds, it is declared a wildfire and suppression action is taken.

Fire management objectives in Wilderness are to permit the natural ecological role of fire and to reduce the fire hazard within Wilderness or the possibility of fire escaping from Wilderness. The suppression policy in Wilderness is the same as it is outside of Wilderness. The suppression response will consider special values, constraints, and management objectives.

Two types of prescribed fires may be approved for use within Wilderness: those ignited by lightning and managed under prescribed conditions and those ignited by qualified Forest Service officers. No fire may be ignited or allowed to burn without documented, preplanned, specified conditions in an approved plan. Forest Service managers may ignite a prescribed fire in Wilderness to reduce unnatural buildups of fuels only if necessary to meet Wilderness fire management objectives and only under the following conditions:

1. The use of prescribed fire or other fuel treatment measures outside of Wilderness is not sufficient to achieve fire management objectives within Wilderness.
2. An interdisciplinary team of resource specialists has evaluated and recommended the proposed use of prescribed fire.
3. The interested public has been involved in the decision.
4. Lightning-caused fires cannot be allowed to burn because they will pose serious threats to life and/or property within Wilderness, or to life, property, or natural resources outside of Wilderness.

FIRE MANAGEMENT PROGRAMS FOR NATIONAL FORESTS

Custer and Gallatin National Forests

Custer and Gallatin National Forests share management of the 921,574 acre Absaroka-Beartooth Wilderness located in south central Montana. The area is within portions of the Big Timber, Livingston, and Gardiner Ranger Districts on the Gallatin National Forest and the Beartooth Ranger District on the Custer National Forest. A Prescribed Fire Management Plan for the Absaroka-Beartooth Wilderness was implemented in 1982. This plan was intended to implement Forest Service Wilderness Policy that states fire in wilderness will be allowed to more fully play its natural role. This was consistent with the definition of wilderness in the Wilderness Act of 1964 as a "community of life," "untrammeled by man," "retaining its primeval character and influence," and "protected and managed so as to preserve its natural conditions."

The objectives of the Prescribed Fire Management Plan include:

- The maintenance of vegetative mosaics and vegetative diversity that are a result of fire.

- The maintenance of plant/animal relationships that have evolved with fire.
- The maintenance of genetic traits that certain species of vegetation have developed in response to fire.
- The maintenance of dead and living fuels in a natural state of continuity, arrangement, depth, and loading.
- A public awareness that fire is a natural and essential component of wilderness ecosystems.

How ignitions will be declared wildfires and an appropriate suppression action is taken on wilderness fires under the following conditions:

- Are person-caused.
- Become a threat to private land, human life and property.
- Will cause irreparable damage to administrative, historical or archaeological sites, or structures.
- Threaten lands or resources outside wilderness boundaries.
- Exceed fire danger prescriptions at ignition.

The Absaroka-Beartooth Wilderness has a relatively low fire frequency. Fires of any consequence occur during periods of severe fire danger. Prescriptions were designed with this fact in mind--to manage lightning fires under natural conditions with a minimum threat to nonwilderness values, human life, or property. Four fire management units were delineated to deal with fire situations in the Absaroka-Beartooth Wilderness: the Absaroka, Monitor Peak, Lake-Buffalo Plateau, and Beartooth. Although each unit has different features, some elements are common to all the prescriptions:

- Human life will be protected as a principle constraint of this plan.
- Lightning fires approaching a unit from outside of the A-B Wilderness will be evaluated on an individual basis as a new ignition. The appropriate suppression response will be taken on the portion of the fire outside the Wilderness or within the presuppression zone. (Editorial note: the presuppression zone is within the Wilderness. Northern Region policy prohibits splitting a fire, part being managed as a wildfire, part as a prescribed fire.)
- Fires that threaten private land, property, structures or sites will be evaluated on a case-by-case basis and protection provided for each situation.

- Fire behavior predictions for fires with potential to exceed 10 acres may be performed by a qualified Fire Behavior Analyst. These will include rate and direction of spread, spotting, resistance to control, fuels, and natural barriers, projected fire size, fire intensities and related fire effects, smoke dispersion, manpower requirements, and regional fire situation.
- Air quality will be evaluated at the time a prescribed fire starts and daily while it is burning. State air quality guidelines will be followed.
- Communication with grazing and outfitter permittees will be established by familiarizing the permittee with the prescribed fire plan.

All fires will be evaluated in terms of the following criteria: five-day weather forecast, air quality, fire behavior projections, fuel and terrain conditions, pre-attack inventories, decision on confinement or containment, manpower preparedness levels, funds available to monitor the fire, regional fire situation, location of outfitter camps, location of structural range improvements, grazing allotments and livestock, location of structures and/or sites, and known concentrations of people.

Fire records for the period 1946-1980 indicate a total of 159 fires. This is a frequency of 4.5 fires/year for all causes and 2.9 fires/year for lightning-caused fires. All fires were 9 acres or less, except for 14 fires between 10-99 acres in size, two fires between 300-999 acres and only one fire larger than 1,000 acres. Aerial photo interpretation suggests that the Absaroka-Beartooth Wilderness has a history of major fires. The Slough Creek drainage particular reveals the periodic occurrence of large fires by the irregular pattern of large stands of even-aged lodgepole. Historical accounts from early Forest Service records (early 1900's) give credibility to these observations.

Characteristically, large fires are infrequent and cover major portions of drainages. However, entire drainages are not entirely burned by any one fire. Fire spread appears to have been spotty and discontinuous, leaving islands of timber and vegetation that create a mosaic pattern. This is probably a result of previous burn patterns, natural barriers, and a relatively short fire season.

Vegetative diversity in the Wilderness is a result of many environmental factors. Mountain pine beetle epidemics followed by fire have shaped many of the mosaic patterns that are visible today. Climate has the most profound effect on distribution of species. Forest vegetation includes Douglas-fir, lodgepole pine, Engelmann spruce, subalpine fir, whitebark pine, and limber pine.

Douglas-fir is found on slopes adjacent to valley bottoms below the subalpine zone, generally from 5,500 to 7,600 feet. Lodgepole pine occurs on all slopes and benches up to 9,000 feet. It occurs in pure stands and in several successional stages within the other vegetative types. Spruce is normally found on moist cool sites in stream bottoms and seepage areas from 5,200 feet to timberline. Subalpine fir can be found at its lower elevational limits on north slopes and in stream bottom frost pockets. At higher elevations it is found on all aspects.

Whitebark pine is an extensive high elevation species that occurs above 8,000 feet on all aspects. Limber pine is found in very small acreages on southern exposures in a few drainages.

Non-forest vegetation in the form of shrubs and perennial grass is widely interspersed throughout the forest areas. Grassland and shrub areas occur along lower reaches of the drainages, with mesic meadows scattered throughout the forested areas. Upper elevations and mountain slopes contain subalpine meadows, with alpine tundra occurring at elevations near and above 10,000 feet.

At least three-fourths of the Beartooth Range is above treeline and consists of tundra and rock. Conversely, three-fourths of the Absaroka Range is forested. Non-forest areas consist of grasslands, meadow types, and scree.

The fuels in the Wilderness have been grouped into two NFDRS models:

Model G represents dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically overmature and may be suffering insect, disease, wind, or ice damage. Model G represents 27 percent of the area and is characteristic of dense spruce-fir bottoms or old lodgepole pine where down woody fuels are abundant.

Model H is described as healthy stands of short-needle conifers where undergrowth is sparse, including healthy stands of lodgepole pine, subalpine fir, and whitebark pine. Model H represents 34 percent of the area. Above 9,000 feet, fuels characteristically change from Model H to non-forest (39 percent of area).

Targhee National Forest

The Targhee fire management policy was implemented as part of the Land Management Plan in 1985. The Wyoming Wilderness Act of 1984 designated two wilderness areas on the Targhee National Forest. The Jedediah Smith Wilderness is 121,200 acres and borders the west side of Grand Teton National Park. The Winegar Hole Wilderness is 10,600 acres and is located along the southwest edge of Yellowstone National Park. Both Wilderness areas and the remainder of the National Forest land are managed under the same fire management policy.

The Land Management Plan specifies fast, energetic, thorough fire suppression with a high regard for human safety. Every wildfire is to be confined, contained or controlled. If the wildfire escapes initial attack, the next step in suppression is decided by an EFSA which will consider such things as cost versus resource loss, weather conditions, safety of the public and/or firefighters, likelihood of spreading, and protection of property. The plan provides for the use of prescribed fire when it is cost effective to achieve other resource objectives.

The goals and objectives of fire management on the Targhee National Forest are included under the Land Management Plan's Resource Protection Program. The primary goal of resource protection is to protect and maintain forest and rangelands. This involves fire protection, insect and disease control, law enforcement and technical assistance. The goals and objectives relating to fire management are:

- Improve wildlife and fish habitat. Use prescribed fire to maintain or enhance wildlife habitat on the Forest responsive to improvement by burning.
- Increase productivity of suitable range. Use prescribed fire to maintain or enhance suitable range.
- Develop fire management plans for all areas. Utilize fire as a management tool to improve resource values such as range and wildlife habitat.
- Complete slash disposal treatments on timber sale areas.
- Reduce fuel loading within dead lodgepole pine stands other than designated slash areas.
- Reduce susceptibility of rangeland habitat to insects, disease and noxious weed outbreak.

Presently there are three fire management areas on the Targhee in which some naturally caused fires will be allowed to burn under certain conditions. A set of prescription guidelines for each management area provide the basis for evaluating prescribed fires and determining whether they may remain in prescribed fire status or must be classified as wildfires and suppression action taken. These guidelines include protection of life and property, probability of the fires escaping from the management area,

threat to livestock, impact on air quality, land ownership in proximity to the management area, key wildlife winter range, and weather. All prescribed fires are monitored on a daily basis by air, lookout or ground station, and/or an on-site monitoring team.

The High Country Fire Management Area consists of approximately 289,865 acres primarily above 8,000 feet. All fires are considered wildfires until the initial evaluation. As a result of the evaluation, fires may be classified as either wildfires (and suppression action initiated) or as prescribed fires. Prescribed fires are evaluated in accordance with the zone prescription guidelines. All fires on private or State lands are suppressed.

The Big Hole Fire Management Area includes approximately 150,000 acres and is subdivided into three management zones:

North Zone--All unplanned ignitions, except pre-and post-fire season (before June 25 and after October 5) are considered wildfires and appropriate suppression action initiated.

Front Country Zone--All unplanned ignitions are considered wildfires and appropriate suppression will be initiated.

Interior Zone--Each new fire start is evaluated. All new fires are considered wildfires until the initial evaluation determines if the fire is a wildfire or a prescribed fire. Prescribed fires are evaluated in accordance with the zone prescription items.

The 121,200 acre Jedediah Smith Wilderness Fire Management Area, all new fires are considered wildfires until after the initial evaluation. As a result of this evaluation, fires are classified as wildfire or prescribed fires. Prescribed fires are evaluated in accordance with the zone prescription items. Evaluation usually includes predictions of the next day's fire behavior on spreading fires, based on the general weather forecast. First-hand knowledge of terrain, features, etc. from the fire site is used in conjunction with the prescription items.

Between the years 1970-1981, there was a total of 344 fires on the Targhee, 48 percent lightning-caused and 52 percent human-caused. From 1976-1981, the average number of human-caused fires doubled. This is likely due to an increase in forest users, including a sharp increase in oil and gas exploration in 1980-1981. In this time period, the forest experienced only six fires over 300 acres (three of these were 10,000+ acres). The total burned acreage for these 12 years is 63,479. The Forest anticipates that occurrence and acreage burned will continue on an upward trend, largely due to increasing hazard from insect-killed lodgepole pine. To reduce fire danger, natural fuel treatment must be accelerated to reduce fuel loading to levels more approximating the natural situation. Most of the lodgepole pine stands on the Forest are dead or dying with heavy (50+ tons per acre) fuel loading.

Vegetation on the Targhee National Forest consists primarily of lodgepole pine in the northern part of the Forest, which borders the western boundary of Yellowstone National Park. The southern half of the Forest, bordering Grand Teton National Park, the John D. Rockefeller Memorial Parkway and the Caribou National Forest is predominantly Douglas-fir. Scattered aspen stands are managed primarily for wildlife habitat. Other tree species, including limber pine, are dispersed within lodgepole pine and Douglas-fir tree types. Sagebrush, grass, and high-elevation barren areas make up approximately 15 percent of the Targhee National Forest.

Bridger-Teton National Forest

The Bridger-Teton National Forest's first Teton Wilderness Fire Management Plan was operational from 1976 to 1979. The Teton Wilderness Fire Management Area encompasses 585,000 acres, including 557,000 acres of wilderness and 28,000 acres which are being considered for addition to the wilderness. The main objective of the plan was to return fire to a more natural ecological role in the wilderness, allowing for creation of a more natural mosaic of vegetation, enhancement of wildlife habitat, and reduction of potential for epidemic levels of insect activity. In 1980, the original plan became inactive, and a revised plan was implemented in 1982.

The objectives of the original plan were better defined in the revision and were divided into land management objectives and fire management objectives. The land management objectives are:

- Maintain or enhance the wilderness characteristics of the Teton Wilderness.
- Maintain or perpetuate natural ecosystems.
- Natural forces of fire, insects, disease and water will be interfered with only to the extent needed to protect human life or property.

The fire management objectives are:

- Provide for the use of natural ignitions to accomplish ecological balance and to break up large fuel concentrations.
- Establish specific areas and weather conditions where unplanned ignitions may be permitted to burn with limited suppression action and/or surveillance.
- Provide for protection of resources values, life, or property while recognizing the benefits which result.
- Provide for coordination with the fire management objectives of the Yellowstone and Grand Teton National Parks and Shoshone National forest.

The Teton Wilderness Fire Management Area is divided into three Ecological Land Units (ELU) based on similar fire behavior, hydrologic characteristics, and geologic stability. These are the Plateau ELU, the Cretaceous Sediments ELU, and the Corridor ELU. The ELU's are divided into nine Fire Management Units, which are stratified based on fuel and topographic characteristics that influence fire behavior, past fire history, and defensibility of the boundaries. Within each of the Fire Management Units are numerous breaks in fuel continuity and natural barriers that will deter fire spread; in some areas administrative constraints require suppression actions. As a result, the wilderness is divided into three Fire Management Zones:

- Zone 1. The largest zone, encompassing the continuous timber types where fires could be large.
- Zone 2. High-elevation, scattered-open, and upper drainage areas where fire spread will be limited by fuels and topography.
- Zone 3. Land that will require suppression action under all circumstances because of administrative constraints.

Based on ecological and resource data of the Teton Wilderness Area and its incorporated Fire Management Units (FMU), special charts are used to make decisions concerning prescribed fires. If all prescription criteria are met, the fire will be declared a prescription fire. If one of the prescription criteria is negated, the fire will be declared a wildfire and suppression action will be taken. The criteria vary among the FMU's, depending on physical features, fire danger, suppression possibilities, smoke management considerations and visitor use. When a natural fire reaches within 1/2 mile of the Teton Wilderness boundary, planned action will be coordinated with the adjacent agency (Yellowstone or Grand Teton National Parks or the Shoshone National Forest).

During the years 1931-1971, prior to the original Fire Management Plan, a total of 157 fires were recorded in the Teton Wilderness. Of these, 87 were less than 1/4 acre in size, 55 were from 1/4 acre to 100 acres in size, and 15 were larger than 100 acres. Sixty percent were lightning-caused and 40 percent human-caused. From 1976 to 1979, when the first Fire Management Plan was in operation, there were 21 fires within the area. Nine were of natural origin and became prescribed natural fires. In 1980 and 1981, there were 13 fires, of which 6 had a natural ignition.

The nine prescription fires that occurred were in the scattered-open vegetative classification at higher elevations in Zone 2. The human-caused fires were at lower elevations in Zones 1 and 3.

Vegetation is generally representative of the spruce-fir type, with less than 1 percent being Douglas-fir or sagebrush-grass types. The Douglas-fir and sagebrush-grass are confined largely to south and west slopes below 8,000 feet. Whitebark pine becomes common above 9,000 feet and is often dominant near timberline. In addition, considerable area is in wet and dry meadows, and large areas are above timberline, particularly in the eastern plateaus.

Overall, 3 percent of the area is classed as riparian meadows, 21 percent is classed as scattered-open area (interspersed timber, meadows, and/or rock outcrops), 20 percent is classed as above timberline or barren, and 56 percent is classed as continuous timber. The continuous timber is about equally split between Englemann spruce-subalpine fir (30 percent) and lodgepole pine (26 percent). Douglas-fir and whitebark pine occur primarily as part of the scattered-open type.

Almost all of the continuous timber is in spruce-fir habitat types. Listed in order of increasing moisture and productivity, the most prevalent are spruce-fir/elk sedge, spruce-fir/heartleaf arnica, spruce-fir/grouse wortleberry types. These occupy 80 percent or more of the continuous timber types. Large areas of each of these habitat types are presently occupied by seral lodgepole pine.

Average ground fuel loading varies considerably by vegetative stand classification, ranging from 38 to 66 tons per acre. Fuel loadings are heavy in the first 30 years after a fire, averaging 54 tons per acre. This is primarily due to large amounts of down trees that were killed but not completely burned by the fire. These down trees decay after a period of 50-60 years, and additional fuel resulting from the developing pine stand is minimal. As succession advances, the fuel loading continues to increase, averaging 57 tons per acre in transition stands and 66 tons per acre in "climax" spruce-fir stands. This increase in fuel load is primarily due to an increase in logs and development of a deeper duff layer. Vertical fuel continuity increases markedly as young Englemann spruce and subalpine fir trees become established. Burning also results in increased grass and forb production, which become reduced as subalpine fir reproduction is established.

Beaverhead National Forest

The goals and objectives of the fire management program are included in the Forest Plan under the Forest-Wide Management Direction. The goals guide the development of management objectives, Forest-Wide standards and management area direction. The lands on the Beaverhead National Forest contained within the GYA total 426,800 acres. Of this total, 101,400 acres comprise the Lee Metcalf Wilderness. The potential for high-intensity fire exists on only 9,700 acres within the GYA on the Beaverhead National Forest.

Broad objectives of the program are threefold: prescribed fire, wildfire management, and public education. These objectives are described in more detail below:

- Prescribed burning is used on the Forest to accomplish several management objectives: preparation of harvested areas for planting, preparation of harvested areas for natural regeneration, stimulation of browse species for wildlife, improvement of range forage for livestock, control of encroaching vegetation, reduction of existing or created fuels, and stimulation of stand reproduction and vigor in aspen and willow.

- Guidelines have been developed for all areas of the Forest through the Fire Management Action Plan to determine how wildfire will be handled. These guidelines reflect the Management Area objectives. In some areas, wildfire will be immediately controlled. In other areas, fire will be contained or confined if that is the most appropriate suppression response based on cost plus loss. Fire in wilderness areas will be allowed to play a more natural role to maintain wilderness character. Cost efficiency is a factor considered in decisions regarding the management of wildfire.
- Education programs will be utilized to better acquaint the public with the positive uses of fire and the beneficial role of natural fire as part of the Northern Rockies ecosystems.

Prescribed fires are fires that will be allowed to burn in accordance with a predetermined set of conditions. In 1979, a Fire Management Plan was prepared and implemented for the Anaconda-Pintler Wilderness. This plan allows for fire to play a more natural role in the wilderness ecosystem. Naturally occurring fires will be allowed to burn when such activity will not adversely affect areas outside the wilderness and lives are not threatened. Prescriptions for fires will be developed for the newly designated Lee Metcalf Wilderness. The same options will be available for proposed Wilderness and unroaded lands managed for semiprimitive recreation.

The environmental effect of the prescribed fire program will depend upon factors such as fuel loading, proximity to valuable resources, and current weather conditions. Decisions to allow prescribed fire to continue must be periodically validated and will be coordinated with the State Air Quality Bureau; however, fires burning for long periods of time may generate smoke which exceeds State air quality standards. A proposal to allow fires to burn is not irreversible. Analyses are made for ignitions to decide whether a particular fire should or should not be suppressed.

The purpose of fire suppression on the Forest is to suppress all wildfires and minimize damage to valuable resources. Control, confinement, and containment are alternatives for accomplishing this goal. Fire suppression strategies in the GYA portion of the forest include 5,700 acres in the control status and the remaining 421,100 acres in confine, contain, or control status. Successful suppression has a favorable short-term effect in areas where timber management is prescribed because it protects the stands from burning. Suppression also results in the establishment of old-growth forests in which some wildlife species are favored and thermal cover is available. Fire suppression leads to a high accumulation of fuels and can result in large, intense fires when burning conditions are severe. These large fires in turn can affect productivity and soil stability. Suppression and exclusion of fire allow older age classes to develop which are susceptible to insect infestations and disease.

In 1979, the Forest entered into an interagency agreement with the Bureau of Land Management, to provide a coordinated and economical aerial detection, fire dispatch, and initial attack system for Federal lands in

southwestern Montana. Under present policy, the Forest takes immediate fire suppression action in all cases of unplanned ignition outside Wilderness. Within Wilderness, fire suppression action is taken on all human-caused fires and lightning fires not within prescribed limits.

Vegetative cover on the forest within the GYA is predominantly forest with scattered meadows and grasslands. Dominant tree species are lodgepole pine, Douglas-fir, Engelmann spruce, and subalpine fir. Lodgepole pine types occur on the moister sites in the intermediate elevations. This type comprises the majority of the commercial forest land on the Forest. These stands represent Douglas-fir and subalpine fir climax communities, but have been historically maintained as lodgepole types through a natural cycle of mountain pine beetle infestations and naturally occurring, stand-replacing fire. Whitebark pine and subalpine fir are common at higher elevations. Above 9,000 feet, the approximate treeline, there is little cover except for patches of alpine vegetation. Vegetative cover is sparse on the steep rocky slopes that comprise a portion of the area within the GYA.

Much of the Forest burned in the years 1879 and 1889. These fires generated the extensive stands of 80 - 95-year-old lodgepole pine existing presently. Protection of the Forest from fire since the early 1900's has allowed Douglas-fir encroachment into grasslands, and allowed lodgepole pine stands to age to a condition of decadence. This has resulted in a reduction of forage available to domestic livestock and wildlife, and has increased the risk of large, catastrophic fires.

Fire data compiled for the years 1940 through 1980 indicate a total of 982 fires occurring on the Forest. Of this number, 71 percent were lightning caused, while 29 percent were human caused. The average number of fire starts on the Forest in any one year is approximately 25, however, this number varies greatly from year to year depending on weather conditions.

Shoshone National Forest

The Shoshone National Forest manages two Wilderness Areas. The Washakie Wilderness totals 687,132 acres and is bordered on the west by Yellowstone National Park and the Bridger-Teton National Forest. The now designated North Absaroka Wilderness is 351,104 acres in size and is located to the east of northeastern Yellowstone National Park. The Washakie Fire Management Plan was implemented in 1978 and the North Absaroka Fire Management Plan in 1979. Recognizing that control of all natural fires is contrary to the wilderness philosophy, both plans provided prescriptions under which some natural fires would be managed in order to perpetuate the diversity of life forms, age classes and species of both plants and animals.

The Shoshone was one of the earliest National Forests created. From 1940 to 1976, what is now the Washakie Wilderness had a total of 123 fires, 25 percent of which were human-caused and 75 percent lightning-caused. The North Absaroka Wilderness had 68 fires, 22 percent human-caused and 78 percent lightning-caused. In the Shoshone National Forest, only 4 fires larger than 100 acres are recorded before 1930 and 13 after 1931. The largest fire of record is the 1935 Crandall Creek Fire in the North Absaroka Wilderness which burned 14,755 acres. Other large fires have

burned 2,000-3,200 acres each. The years of record in which large areas have burned are 1910, 1911, 1919, 1935, and 1937. In general, the years in which large fires have occurred reflect the existence of drought conditions.

Washakie Fire Management Program

The primary objective of the Washakie Fire Management Plan is to perpetuate natural ecosystems. The fire prescriptions that determine when, where, and how naturally occurring fires will be allowed to more fully play their role are based on the following assumptions:

- Fire is a natural part of ecosystems in the Washakie, and is necessary to perpetuate and maintain these ecosystems.
- Suppression of natural fires, if continued, will have an increased adverse effect on area ecosystems.
- Fires will be managed under specific prescription designed to perpetuate natural ecosystems.
- Fires will be controlled if they threaten human life and/or property, populations and habitat of threatened or endangered species, or when unacceptable damage would occur to resources.
- Fires will not be allowed to spread outside the wilderness.
- Large fires will not burn every year.
- Most large fires of record were human-caused.
- Human-caused fires will be controlled at all times.
- Qualified personnel will make fire management decisions.
- The public is interested in fire management decisions.

For fire management purposes, the Washakie Wilderness has been subdivided into Ecological Land Units (ELU's) and Fire Management Units (FMU's). The purpose of the ELU's is to group land forms, climate and vegetation into similar units where fire effects and behavior can be evaluated to allow natural fire to resume its role in the development and maintenance of these ecosystems. Four ELU's of similar character were recognized: Alpine ELU, Engelmann Spruce-Alpine Fir-Whitebark Pine ELU, Mesic Douglas-fir ELU, and Xeric Douglas-fir ELU.

The Alpine ELU totals 358,196 acres or 52 percent of the Washakie Wilderness area. It occurs above 10,000 feet on remnants of flat, volcanic plateaus or on rugged, steep, glacial topography. This ELU does not burn to any significant degree. Whether vegetated or not this unit separates most major drainages and forms very effective fire barriers.

The Engelmann Spruce-Subalpine Fir-Whitebark Pine ELU totals 249,718 acres and composes 37 percent of the Wilderness area. This unit consists of a mosaic of associations between Engelmann spruce, subalpine fir, lodgepole pine, and on xeric sites, whitebark pine and Douglas-fir. Fire has been responsible for this mosaic pattern and subsequent vegetational development. Generally, succession is toward subalpine fir climax communities. Subalpine fir dominates tree reproduction and often forms continuous fuel ladders from ground to aerial fuels. Estimates of ground fuel loading range from 50 to 60+ tons per acre. The arrangement and volume of ground fuels indicate potential for large fires, yet large fires do not occur frequently. Stand structure and age indicate large fires burn at a frequency of 250-300 years.

The Mesic Douglas-fir ELU totals 49,864 acres, or 7 percent of the Washakie Wilderness Area. This ELU is dominated by the Douglas-fir/pinegrass and Douglas-fir/snowberry habitat types. A sprinkling of the Douglas-fir/blue huckleberry and Douglas-fir/elk sedge types are also present. Fire strongly influenced the vegetative development of this unit, with fires occurring frequently on a cycle between 50-150 years. Douglas-fir dominates the community in both seral and climax stages, although seral stands may consist of even-aged lodgepole pine or Douglas-fir. Fuel loading varies from light to moderately heavy. Estimated ground fuel loading ranges from 10 to 50 tons per acre. Where fire has successfully maintained seral stands, a more open understory occurs and fuels mostly consist of small branches and fine fuels contributed by grass and brush species.

The xeric Douglas-fir ELU totals 29,354 acres, or 4 percent of the total management area. This unit is characterized by Douglas-fir/bluebunch wheatgrass and Douglas-fir/Idaho fescue habitat types. There is a marked difference between north and south aspects. Northern aspects contain small timber stands dominated by Douglas-fir. Southern aspects consist of widely scattered trees, mostly limber pine, Rocky Mountain juniper, sagebrush and grass clumps. Sage-grass types become locally dominant on some bottom areas. Fuel loadings are generally light, ranging from an estimated 10 to 20 tons per forested acre to 5 tons per non-forested acre. Fuel accumulation on northerly aspects is slow. On southerly aspects, fuels are widely scattered and concentrated beneath trees and brush. Fires average 50 to 100 years between cycles in this ELU and generally are low-intensity, fast-moving ground fires.

The ELU's are made up of large, expansive management units that make it difficult to relate to specific land area management problems, thus the area was divided into FMU's. FMU's characterize localized areas of similar land character. There are a total of 15 FMU's and the prescriptive management criteria for each FMU include public safety, Energy Release Component values, existence of other fires in the unit, fire size and behavior, and fire location (proximity to improvements, high-use areas, restricted areas and boundaries).

Because it would be cumbersome and time-consuming to have to re-read each ELU or FMU rationale when a fire is reported, a series of maps and dichotomous decisions charts were developed. The Wilderness area was

divided into three zones. A map and dichotomous key were prepared to summarize general prescriptive criteria applicable to the area as a whole and to each specific zone. The zones are:

- Zone I. Observation. Consists of areas where there is no potential for large fires to develop. This includes alpine types, small, broken timber stands at high elevations or along rocky ridgetops, and timbered basins near the head of drainages. Fire in this zone generally will be observed. Containment or suppression may be considered if a fire threatens to burn outside the wilderness boundary or threatens Zones II or III.
- Zone II. Suppression or Containment. Requires immediate suppression or containment of all fires with spread potential. This zone was necessary to protect areas of heavy public use, improvements, and to identify areas where fire could seriously affect non-Wilderness lands.
- Zone III. Prescriptive Fire Management. This zone consists of areas where natural fire will be managed under specific management prescriptions.

Additional dichotomous charts were developed for various FMU's. Fires are evaluated using chart criteria. All human-caused fires are suppressed. If the fire is lightning-caused and does not need to be contained or suppressed, it is plotted on topographic maps and aerial photos and its progress monitored. Each fire is constantly evaluated to insure prescriptions are being followed.

North Absaroka Fire Management Program

The objectives of the North Absaroka Fire Management plan are:

- Implement fire management in the North Absaroka Wilderness Area under the general directions set forth in the North Absaroka Wilderness Management Plan and in the Forest Service manuals 2320 and 5100. Fire management is defined as "all activities required for the protection from fire and the use of fire to meet land management goals and objectives."
- Analyze the area to determine places and conditions where natural fire will be managed to assume its historical role in the development and maintenance of fire-dependent ecosystems, indigenous to the North Absaroka Wilderness.
- Assimilate data in a logical format to assist the land manager in fire control operations when and where some form of control is necessary.

The North Absaroka Fire Management Plan delineates 31 vegetative cover types in the Wilderness area. There are nine Douglas-fir types, four whitebark pine types, five spruce-fir types, seven lodgepole pine types, one

alpine type, one meadows type and one sage-grass type. Mid-elevation sites (7,000-9,000 feet) comprise most of the areas that have burned in the North Absaroka Wilderness. Here lodgepole pine is a prevalent pioneer tree and forms extensive cover types with understories of soapberry and grouse whortleberry. Engelmann spruce and subalpine fir establish under the lodgepole pine canopy and eventually compete with it in the overstory. The calculated interval between large fires in this area is 117 years. This should be interpreted as a potential minimum age at which stands are capable of sustaining a major fire.

One 117-year interval may represent the age at which fuels have accumulated to the point that fire spread is likely given favorable environmental conditions. Prior to a mid-transitional stage of succession, only small amounts of fuels, particularly of large dead and down timber, are available for fire consumption. (There is one exception to this rule: that is that fire can sometimes cause an increase in large dead and down fuels. This was evident in parts of the Crandall Creek Fire and Blackwater Fire where after a number of years the trees killed by the original fires have accumulated.)

Fuel loading in Douglas-fir types vary from 44 to 90 tons per acre. In Engelmann spruce-subalpine fir types, fuel loading ranges from 67 tons per acre in late transition stages to 91 tons per acre in the climax stages. Fuel loading in lodgepole pine types varies from 31 tons per acre in early transition stages to 120 tons per acre in late transition stages.

Fire management prescriptions for North Absaroka Wilderness are based on the following assumptions and decisions:

- Fire is a natural part of ecosystems in the North Absaroka and is necessary to perpetuate and maintain those ecosystems.
- Fire suppression of all natural fires, if continued, will have an increased adverse effect on area ecosystems.
- Large fires will not burn every year.
- The public is interested in fire management activities.
Decisions:
 - Fires will be managed to perpetuate natural ecosystems.
 - Fires will be controlled if they threaten human life and/or property, population, and habitat of threatened or endangered species, or when unacceptable damage would occur to resources.
 - Fires will not be allowed to spread outside the wilderness, unless an approved fire management plan exists adjacent to the wilderness.
 - Human-caused fires will be contained at all times.

- Qualified personnel will make fire management decisions.
- Fire-fighting techniques which have the least adverse impact on the wilderness ecosystems will be utilized.

There are 10 designated Fire Management Units in the North Absoraka Wilderness. These are land units that ideally have well-defined topographical or administrative boundaries within which lies land with similar burning characteristics. There are also three identified Fire Management Zones. All three zones may or may not be present in each Fire Management Unit. The zones are:

- Zone I Protection Area. This is a unit of land that needs to be protected from fire generally for administrative reasons (heavy recreation or livestock use, historical sites, wilderness boundary).
- Zone II Prescription Area. This is a unit where natural fire will be managed to more nearly resume its historical role in the ecosystem when prescription requirements are met.
- Zone III Low Potential Area. This is a unit with low fire potential and low potential for serious conflict with other uses. Scattered whitebark pine and alpine zones are primary types in this area. In general, fires in this area will be observed.

Zones are listed in order of priority. Where a unit boundary or zone conflict occurs or is likely to occur, the more restrictive zone's prescription takes preference.

SECTION 4: FIRE ENVIRONMENT AND FIRE BEHAVIOR

FIRE ENVIRONMENT

Weather

While many parts of the United States were experiencing drought in early 1987, the GYA was minimally impacted. The Palmer Drought Index, which considers such factors as precipitation, evaporation, and soil moisture, indicated that the GYA was in a mild moist period on August 29, 1987. September and October, however, were record dry months, with no precipitation recorded. By the end of December 1987, the GYA was in a mild drought condition.

At the end of April 1988, the Palmer index showed a rapidly expanding area of severe to extreme drought from California, Oregon, and Washington, eastward into the Northern Rockies. The indices showed that a moderate to severe drought was in place over the GYA. Snowpack and precipitation totals for the winter and early spring months were well below average. At Mammoth, precipitation in May, 1988 was 3.7 inches, twice the average for the month. But conditions worsened from mid-May to mid-June, and the drought index for the GYA went from severe to extreme. Little relief occurred from mid-June through August as the drought index showed a deteriorating situation.

The average annual precipitation for the 1951 to 1974 period was 15.87 inches. The twelve month precipitation at Mammoth (September 1987 to August 1988) was 9.81 inches, 62 percent of the 1951-1974 average. As is depicted in figure 3, the 1987-1988 period was drier than the average, except for April and May, when 5.55 inches of precipitation fell in those two months. (Mammoth may depict a "worst case" situation and may not typify weather over the GYA.)

The weather pattern across the Eastern Pacific into the West Coast varied very little during the winter and spring. The flow at the upper levels of the atmosphere was typified by strong westerly winds to the West Coast. As the jetstream moved inland, it split, taking a portion of the incoming storms northeastward into British Columbia before turning southeastward east of the Continental Divide. The southern portion of the split steered storms south along the California Coast into Northern Baja, then back northeastward across portions of Arizona and New Mexico into Colorado. The split flow joined across the eastern half of the Nation. This pattern resulted in a northwesterly flow of air into the GYA that was quite cold and dry.

As spring gave way to summer, high pressure became established over the central Rockies, with an area of low pressure dominating off the Pacific Coast. As was the case in many areas of the nation, temperatures were above normal over the GYA. More importantly, with a west to southwesterly flow over northwest Wyoming during July and August, precipitation did not move northward into western Wyoming, as in past summers. Thunderstorms that occurred over the GYA produced lightning but little rainfall.

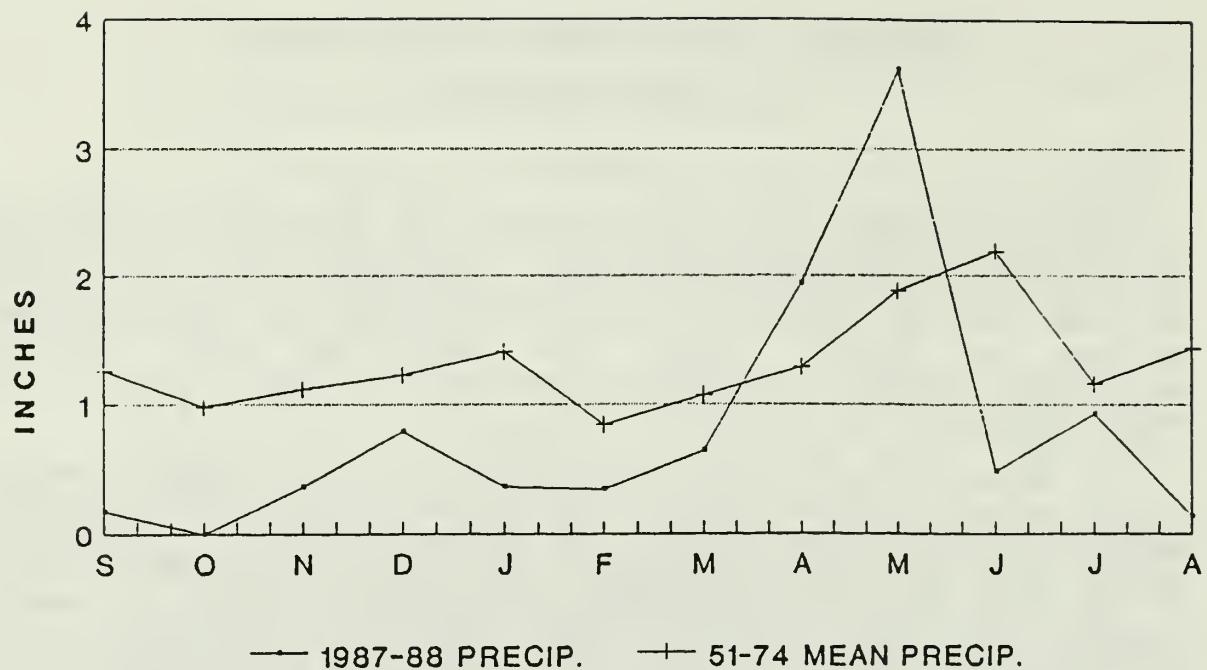


Figure 3. Mean precipitation 1951 - 1974 compared to 1987 - 1988 precipitation, Mammoth, WY.

July and August were extremely dry months characterized by persistent low relative humidities and strong southwest winds. Even the typical summer southwest wind of 10-20 miles per hour resulted in high fire intensities and high rates of spread.

The prevailing westerly flow in the upper atmosphere was favorable for the passage of a series of dry cold fronts. At least six dry cold fronts crossed GYA during this period, each producing strong southwest to west wind gusts of between 40-60 miles per hour. At such times the fires made their major runs.

The first dry cold front moved through the area on August 1st, producing southwest winds of up to 40 miles per hour. Another, somewhat weaker cold front, was noted the 6th, with winds in the 15-25 miles per hour range. The next dry cold front pushed through the 15th, with steady winds of 20-25 miles per hour and gusts to 40 miles per hour. It was during this frontal passage that the North Fork Fire burned through Madison Junction. Weather observations, taken at Madison Junction just before the fire moved through, showed a relative humidity of just 7 percent, with winds to 35 miles per hour.

A stronger dry cold front, supported by a well developed upper level low pressure system, moved through the GYA on Saturday, August 20th. Sustained winds of 20-40 miles per hour were observed most of the day, with gusts over 60 to 70 miles per hour on the higher ridges. Relative humidities remained low. Ten days later, another dry cold front, with gusts to 40 miles per hour pushed the fires farther to the northeast and east.

Two more dry cold fronts moved through the GYA in early September, one on the 6th and another on the 10th. The front on the 6th produced winds of up to 50 miles per hour on the Storm and Clover-Mist Fires, and gusts to 60 miles per hour on the higher peaks. The second cold front, on the 10th, also produced strong winds. However, cold, moist air behind the front finally brought significant precipitation. Light rain began falling late the 10th and turned to snow on the 11th, leaving 1/2 inch to 2 inches of snow in most places, and up to 4 inches over the higher elevations. Cool, damp weather continued through September 20 as more and wetter storms moved into the Northern Rockies.

The 1988 fire season was characterized by abnormally low relative humidities throughout the GYA. Except for a few days, minimum relative humidities were consistently below 20 percent and occasionally below 10 percent. The lowest humidity reported was 6 percent at Tower Falls on August 22.

Fire Danger

Fire danger graphs produced by the Southern Forest Fire Laboratory (Forest Service) at Macon, GA, illustrate the overall potential flammability of forest fuels in the GYA during the spring and summer of 1988. Two broad National Fire Danger System (NFDR) components were used to categorize the fire danger situation in the GYA: the Energy Release Component (ERC) and the NFDR-1000 Hour fuel moisture content. Fire managers commonly use the ERC to

guage the severity of individual fire seasons, and to compare the present fire season to one in the past. The NFDR-1000 Hour fuel moisture content is used to ascertain the relative fuel moisture of the larger, slower-drying fuels within a fire rating area. When compared with 1000-Hour values from past fire years, it is an excellent indicator of the potential severity of the upcoming fire season.

Three fire danger weather stations were selected from among those in the GYA: Hebgen Lake Ranger Station, Gallatin National Forest, at West Yellowstone, MT (6643'); Yellowstone National Park Headquarters at Mammoth (6239'); and Bechler Ranger Station (6400') in the extreme southwest portion of Yellowstone National Park, southwest of the Continental Divide. (Weather at Mammoth may not typify much of the GYA and may portray a worst-case situation.)

A set of graphs was created for each weather station, one graph for the ERC and one for the NFDR-1000 Hour moisture content (fig. 4-9). Each graph compares the 1988 fire season (solid line) to the 1981 fire season (dotted line) for a forested fuel type (Fuel model G). The fire season of 1981 was selected for comparison because it was a year characterized by considerable fire activity.

The 90th and 97th percentile line, drawn across the ERC graphs, mean that 90 and 97 percent of the time the ERC is less than these averaged values. Over the years, fire managers have linked ERC values with actual "real-time" fire behavior, often developing rules of thumb that help them predict the severity of the upcoming fire season. One such rule is that fires begin burning both surface and aerial fuels at ERC's above the 90th percentile line. At such ERC levels, intense fire behavior, including spotting, torching, and crowning, would be expected.

Mammoth (fig. 6,7) was at the 90th percentile level in early June, reaching the 97th percentile in July and staying there through August. The readings stayed at this high level for nearly two months. Bechler (fig. 4,5) and Hebgen Lake (fig. 8,9) stations reached the 90th percentile in July and the 97th percentiles later in July and August.

As is displayed on each ERC graph, there is a significant separation between the 1988 and 1981 lines. Beginning in May or June, the 1988 line shows higher ERC values than the 1981 line. For Mammoth, from May to August, there is nearly a 20-point difference between the two years. Bechler and Hebgen Lake have much lower divergences, but in each case, the ERC is still higher than the 1981 line.

Again, it must be emphasized that the comparison is between a very severe fire season (1988) and an historically severe fire season (1981). If 1988 was compared to a 10-year average ERC, the distance between the 1988 ERC line and the 10-year average ERC line would be even larger than for 1981 and 1988.

The most significant trend the ERC and NFDR-1000 Hour graphs portray is the early arrival of a fire season that could produce extreme fire behavior.

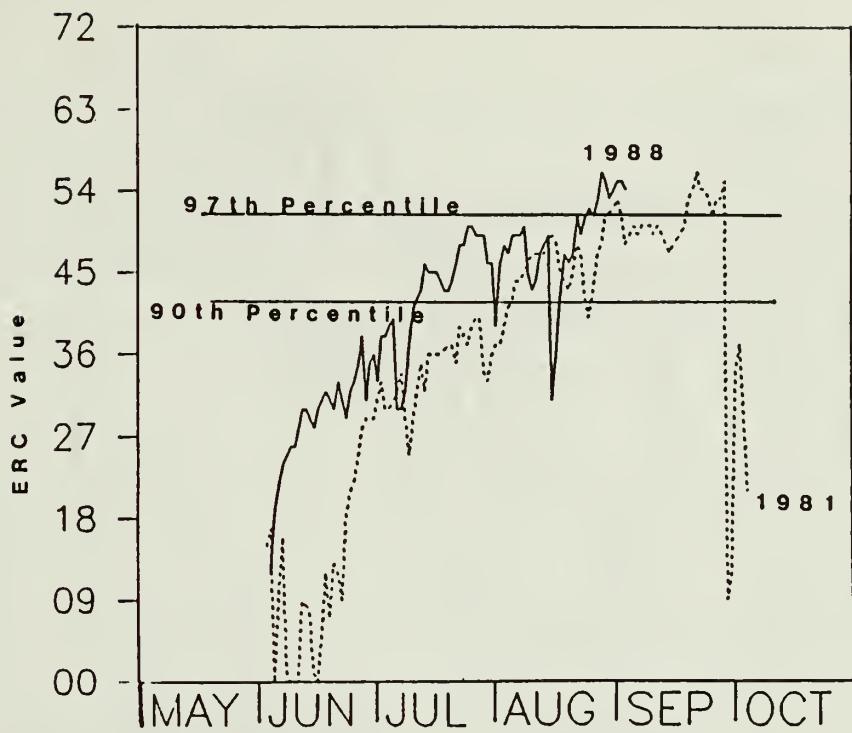


Figure 4. Energy release component, Bechler, 1988/1981

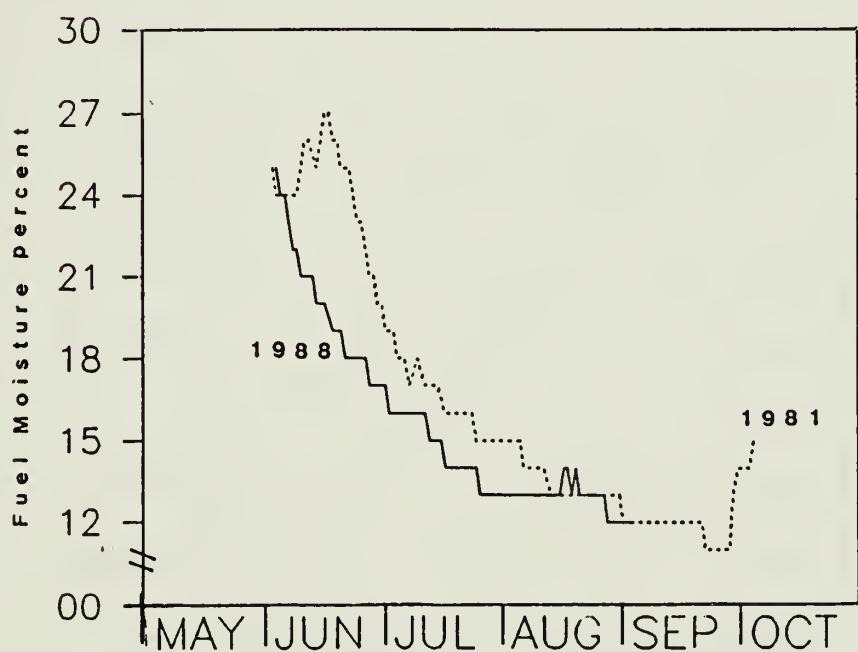


Figure 5. 1000-Hour fuel moisture, Bechler, 1988/1981

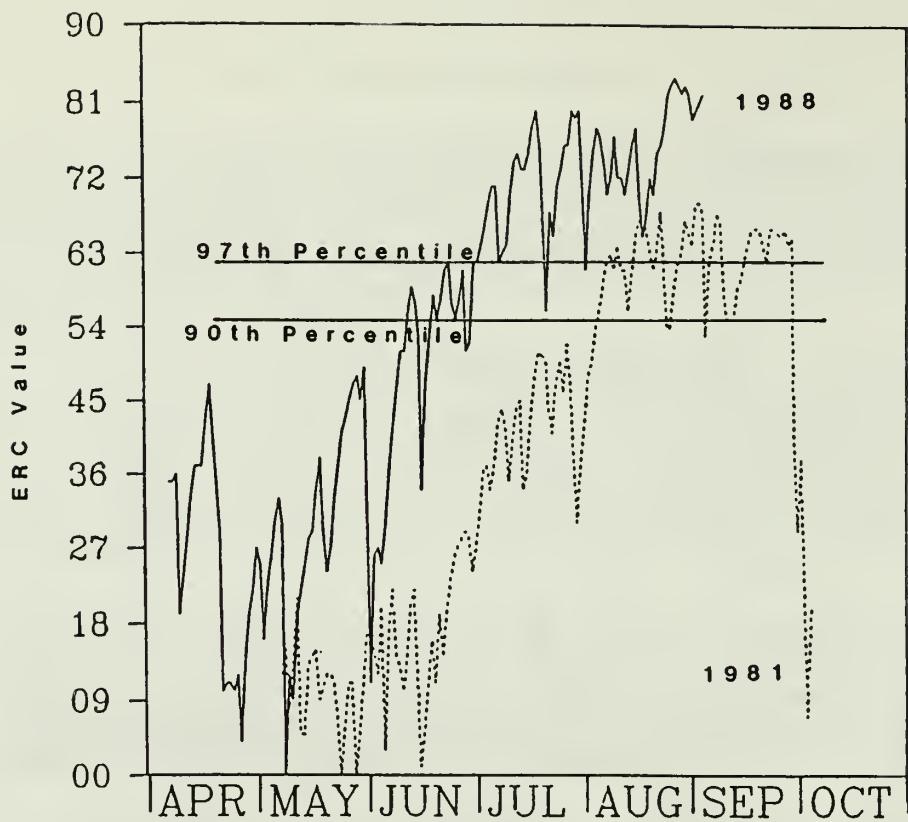


Figure 6. Energy release component, Mammoth, 1988/1981

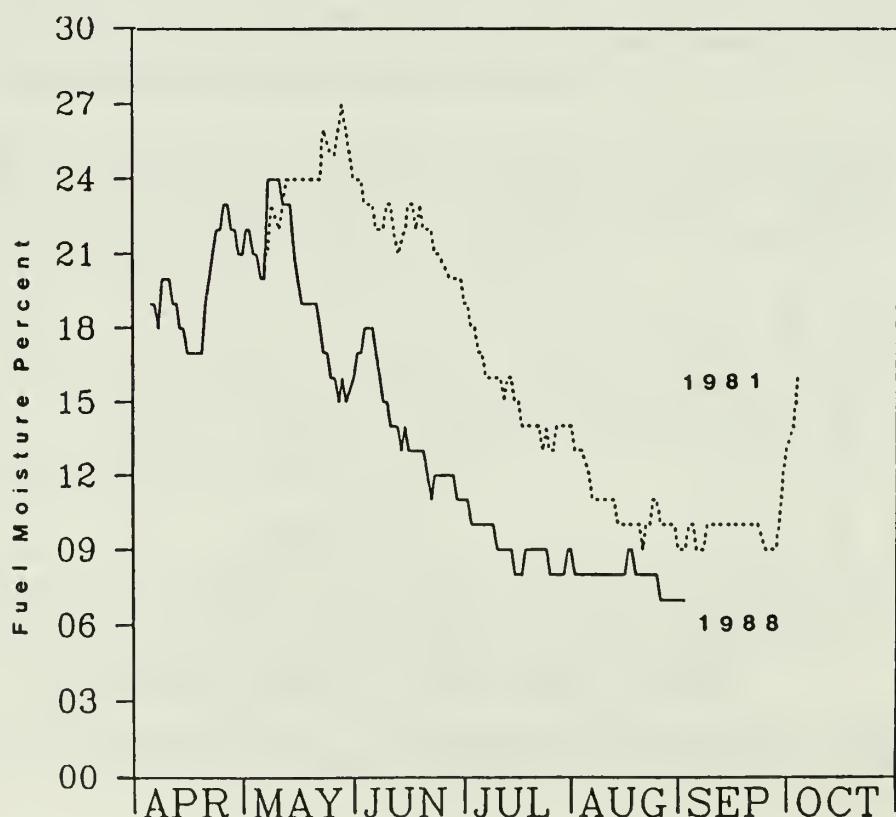


Figure 7. 1000-hour fuel moisture, Mammoth 1988/1981

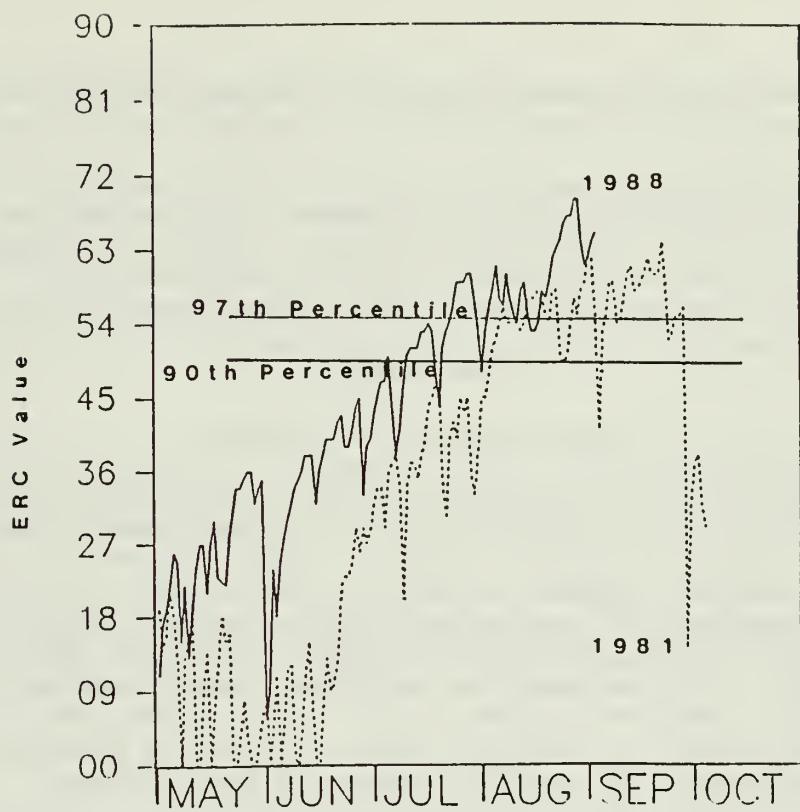


Figure 8. Energy release component, Hebgen, 1988/1981

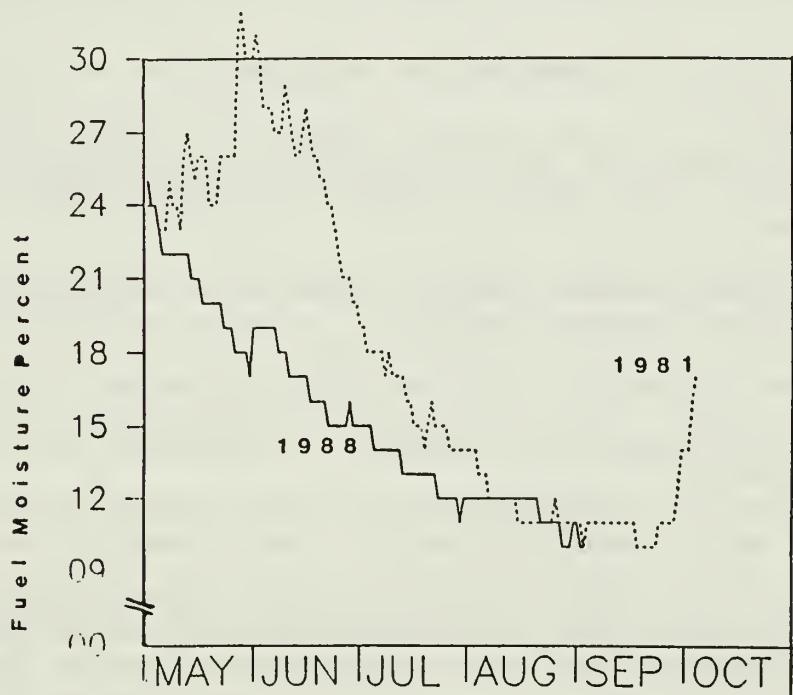


Figure 9. 1000-Hour fuel moisture, Hebgen, 1988/1981

Fire danger readings that normally appear in August began developing in June and early July.

Similar trends were established using other components of the NFDR system--burning index (BI), spread component, and live and herbaceous fuel moistures. Using data for June and July, these indexes and components indicate that a serious fire season might be approaching, and that it could be substantially "hotter" than the last hot fire season of 1981.

FIRE BEHAVIOR

Unprecedented Fire Behavior

Fire historians have found evidence of fire dating back 5,000 years in Yellowstone Park. A recent analysis of fire scars showed that large fires burned near Yellowstone Lake in 1750 and 1850. But not in recent history have so many large, uncontrolled forest fires burned across such remote, inaccessible sections of the Western United States. Greater Yellowstone Area fire behavior during the summer of 1988, as measured by fire intensity, rate of spread and fire size, was at levels easily compared to the Big Blowup of 1910 in Montana and Idaho, and to the spectacular fire storms of the 1967 Sundance Fire in northern Idaho. Yellowstone National Park's last "big" wildfire was in 1886, and it burned only 25,000 acres.

In 1988, the fire behavior record book was rewritten, a year when new charts and procedures had to be developed so fire behavior analysts could accurately predict the spread and intensity of these fires. Firefighters had to reframe their mental images of fires, using new scales and perspectives. For example:

- a 15,000 acre blowup on the North Fork Fire was simply called a "slopover;"
- fires burned with various intensities, sometimes burned over light fuel beds that would have been un-burnable during average fire seasons;
- the flanks and rear areas of fires became fire fronts as six dry cold fronts crossed the GYA;
- rates of spread of 2 miles per hour in forested fuels;
- five and 10-mile fire advances in a single day were predicted and observed;
- spotting was frequent with new fires starting 1/2-mile to 1-1/2 mile beyond fire fronts;
- fires easily jumped such natural barriers as Yellowstone Canyon, the Madison River, two-lane highways, and the entire complex of buildings, parking lots, and unvegetated geyser basins at Old Faithful;

- convection columns with cumulus cloud caps were commonplace. A meteorologist counted 17 such columns in one afternoon on one fire;
- the Mink Fire released an estimated 3.5 trillion BTU's per hour, enough to heat 4,400 homes for one year;
- smoke plumes drifted from the western side of the GYA and substantially reduced activity on fires on the east side of the GYA;
- localized firestorms were a result of super-dry fuels and wind. Although spectacular, these intense storm events were short lived and covered relatively small areas, thus only influenced minor portions of the GYA;
- independent crown fires developed under high wind conditions. These fires spread at high rates, and created peculiarly long, narrow swaths of fire unimpeded by terrain or fuel type. Two such patterns can be seen southwest of Old Faithful;
- evidence of horizontal vortices was seen on the North Fork Fire in the Gallatin River drainage. This is an extreme form of fire behavior and leaves parallel strips of burned and unburned fuel;
- major fire runs often developed downwind of fire fronts that had been "seeded" with large numbers of fire brands. The high probability of each hot ember surviving to become a flaming fire contributed to this intense spotting.

Fire Behavior Characteristics

Neither heat, fuel, nor oxygen dominated GYA fire behavior, for each factor was unique, and in combination sometimes produced extreme fire behavior.

When oxygen was added via an increased wind speed, the fires grew dramatically regardless of natural barriers or sparse fuels. Even light winds caused the fires to convect and spread. Without wind, however, the fires still burned intensely, often slowly backing into fuels. At these times, the fires could be said to be "fuel driven." As the fires grew larger, finally encompassing thousands of acres, there was always an unchecked source of heat capable of igniting new fire advances.

Fire behavior analysts began calibrating their fire spread models to account for the extreme rates of spread. In some of the heavier fuel types, rates of spread averaged 1/4-mile per hour, and under the influence of wind, spread rates were as high as 2 miles per hour. The spread rate for the fire run at Old Faithful was estimated to be 3/4-mile per hour. Experts from the Forest Service's Intermountain Fire Sciences Laboratory recommended that fire model spread rates be doubled and even quadrupled to predict the rates observed in the GYA.

Forest fires are usually visualized and modeled as continuous surface fires spreading with the prevailing wind. However, in the GYA in 1988, airborne embers, often carried by strong winds, were the primary cause of area growth, resulting in behavior outside the predictions of fire spread models. The spotting/spread scenario was as follows:

Small stands of trees would begin burning intensely, flames shooting 100-200 feet above the tops of the 80-foot trees, the smoke beginning to rise in a convective column. Hot embers would be lifted up and away in the rapidly ascending smoke plumes, often landing in dry fuels ahead of the fire. These new spot fires would quickly grow from smoldering to flaming fires. The indrafts from the main fire would pull the spot fire toward it. Soon, however, the spot fire would develop greater intensities than the spotting source, and, in its need for oxygen, the spot fire would begin drawing the main fire with its indrafts. This pulsing action, one fire drawing into another, then reversing, was responsible for thousands of acres of fire spread in the GYA.

Fuels

The fuels that contributed to dramatic fire behavior in 1988 were literally born of earlier fires, for fire, more than any other single factor, is responsible for the establishment and structure of most of the forests. The GYA is dominated by forested fuels categorized as old and mature. A majority of these fuels are stands of lodgepole pine in early to late stages of succession. Most of the stands have been infested by the mountain pine beetle. Trees killed by the beetle usually fall after five years and then become part of the heavy fuel buildup.

Fuel quantities and fire potential become predictably high as lodgepole pine stands mature. As the stands age, the more shade-tolerant subalpine fir and Engelmann spruce become established. This heavy loading of both standing and fallen snags, in combination with the flammable subalpine fir and Engelmann spruce, fueled the many high-intensity fire runs in 1988. A report issued in 1987 indicated that over 50 percent of the GYA had moderate to high potential for high-intensity fires.

As the fire season progressed into late August, fires readily spread through all fuel types regardless of fuel loading and continuity. Firefighters often saw spectacular fire behavior: fire storms, crown fires, flames illuminating miles of night sky. Nevertheless, fire intensities ranged from creeping surface fires that hardly killed a tree to high-intensity crown fires that totally consumed most aerial and ground fuels.

Fuel Moisture

Measured fine fuel moistures were as low as 2 percent, with averages between 3 and 15 percent. An "average" range of fuel moistures for the summer period would be 8-12 percent.

In many cases, the large fuels (3"+ in diameter) were as dry as the small fuels. Moisture content of large fuels ranged between 7 and 5 percent, truly incredible readings when one realizes that the average range for small fuels (1/4" or less in diameter) fell within this range. (Moisture content of kiln-dry lumber is about 12 percent.)

The extremely low fuel moistures in all size classes were the primary reason for fires burning as strongly at night as during the day. Lack of moisture within both the fuels and the environment surrounding the fuels caused a situation to develop where fuels did not respond at night. Normally, fine fuel moistures rise, though not at the same rate, as the relative humidity increases. But scientists from the Forest Service's Intermountain Fire Sciences Laboratory, measuring both fine fuel moisture and humidity every hour for 48 hours, found that fuel moisture only responded slightly to increased humidities (fig. 10).

Fire Weather

Of all the weather factors influencing the fire behavior in the GYA, wind probably had the most direct impact, often driving spectacular fire behavior. The one-day 14-mile fire run down Jones Creek on the Clover Mist Fire was wind influenced. The September 7th North Fork Fire run on Old Faithful was the combined result of a wind-driven fire following topographic boundaries.

Firefighters soon learned the tremendous influence nighttime winds had on fire spread. There were many occurrences of high-speed nighttime diurnal winds following rivers or canyons downhill, forcing the fires to spread toward and against control lines. On September 3, the 15,000-acre slopover on the Targhee National Forest near the point of origin of the North Fork Fire was the direct result of extremely strong nighttime down-slope wind pushing a small spot fire to thousands of acres at spread rates of over one mile an hour.

The most significant wind event occurred on Saturday, August 20, during the afternoon and evening hours. Winds of 50 miles per hour, with some reports of up to 70 miles per hour, resulted in the fires growing in size by an estimated 160,000 acres. The Clover-Mist gained 46,500 acres, Hellroaring 25,000 acres, Storm Creek 18,500 acres, and North Fork 14,900 acres. Two major new starts, Huck and Hunter, were caused by downed powerlines. The Huck Fire raced 4 miles in 45 minutes.

Other weather factors influenced GYA fires. Relative humidities in August were often below 20 percent and sometimes as low as 6 percent. The normal summer humidity range for the GYA is 15-30 percent. Near record-breaking temperatures were reported throughout the area. As valley

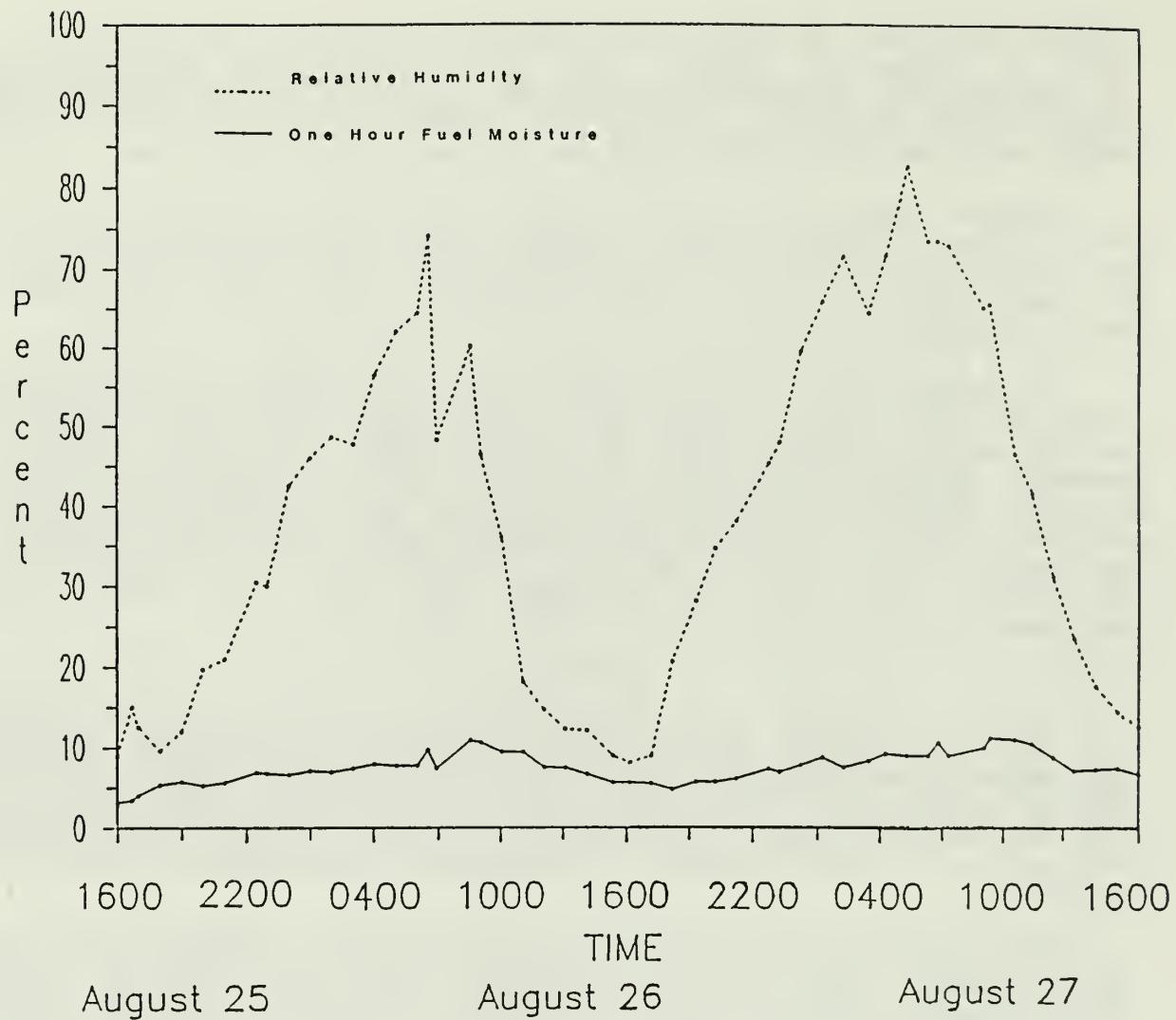


Figure 10. North Fork Fire, 25 - 27 August, diurnal relative humidity and moisture content of 1-Hour fuels.

smoke inversions broke up in the early afternoons, the fires would instantaneously come to life. Fuels that were smoldering would begin to flame; areas that had been mopped up would begin smoking again; spot fires that lay dormant beneath a blanket of smoke would again begin torching out and throwing embers. As one veteran firefighter put it, "When the smoke lifts, it's like letting the heat out of the oven."

Topography

The topography of the GYA is a mixture of deeply glaciated, high-elevation mountains that give way to relatively flat plateaus and broad valleys. The Madison Plateau and the Lamar Valley are two noteworthy examples. Topography not only influenced fire behavior, but hampered firefighters' efforts to contain the fires. Large, flat expanses of densely forested landscape without prominent natural features, made it difficult to pinpoint locations. The fires were located in remote parts of Parks and Wildernesses, with roads only to portions of the fire perimeters. Good sites for anchoring fire lines were scarce. Major river drainages such as the Yellowstone, Firehole, and Madison created their own micro-weather patterns, either funneling the winds up or down canyon, depending on drainage orientation and wind direction. Even small creek channels became conduits that carried the fires along like water in a pipe.

The Continental Divide crosses the southern end of the GYA, compounding the difficulty of fire weather forecasting. Often, winds might blow in one direction south of the divide, and from the directly opposite direction north of the divide.

SECTION 5: AREAWIDE 1988 FIRE OCCURRENCE

Fire occurrence data for 1988 for the GYA is presented in Table 1 and represents fires originating from all sources of ignition including lightning, humans and any other event resulting in fire. Each of the units comprising the GYA reported fires according to number, size, status and initial classification.

Table 1-Greater Yellowstone Area fire occurrence.

Unit	Acreage			Total	Initial Classification	
	0-1	1.1-10	10+		Prescribed	Wildfire
Beaverhead NF	3	0	3	6	0	6
Bridger-Teton NF	22	7	5	34	1*	33
Custer NF	9	0	2	11	1**	10
Gallatin NF	43	6	2	51	0	51
Grand Teton NP	15	2	2	19	1	18
Shoshone NF	15	1	5	21	0	21
Targhee NF	47	6	4	57	0	57
Yellowstone NP	24	2	24	50	28***	22
Totals	178	24	47	249	31	218

* Mink Fire-started 7/11 and declared a wildfire 7/14

** Storm Creek Fire-started 6/14 and declared a wildfire 7/03

*** Twelve fires burned out at less than 1 acre and the rest became wildfires

A total of 249 fires occurred in the GYA in 1988. Of this total, 31 were initially classified as prescribed fires. Twenty-eight of these were in Yellowstone National Park. Eventually, 12 of Yellowstone National Park's prescribed fires burned out at less than 1 acre; the other 16 fires were later declared wildfires. The remaining three prescribed fires were on the Bridger-Teton and Custer National Forests, and in Grand Teton National Park. Both of the National Forest prescribed fires were later declared wildfires; the Grand Teton National Park prescribed fire burned out at less than 1 acre.

Table 2 shows 1988 GYA fires by month and cause. Three of the largest fires, the North Fork (400,100 acres), the Wolf Lake (107,460 acres) and the Huck (225,000 acres) were caused by humans (including trees and powerlines), and totaled nearly half the area burned.

Table 2-Fire Occurrence by Month (Human Caused/Lightning Caused)

Unit	January	February	March	April	May	June	July	August	September
Beaverhead NF	--	--	--	--	--	0/1	1/3	1/0	--
Bridger-Teton NF	--	--	--	--	0/4	1/0	2/10	7/9	2/0
Custer NF	1/0	--	--	--	--	0/3	2/3	1/1	--
Gallatin NF	--	1/0	--	2/0	1/0	3/6	8/12	8/4	6/0
Grand Teton NP	--	--	--	--	0/3	1/0	6/4	4/1	--
Shoshone NF	--	--	--	1/0	1/2	1/7	1/4	1/3	--
Targhee NF	--	--	--	--	3/2	3/3	13/10	6/12	5/0
Yellowstone NP	--	--	--	--	0/1	1/7	4/25	4/9	--
Total human-caused fires = 99					Total lightning-caused fires= 150				
Percent human-caused fires = 39.8 percent					Percent lightning-caused fires = 60.2 percent				

It is evident from the table that most of the fires of the GYA in 1988 occurred in the summer months. Approximately 40 percent of the GYA fires were caused by ignitions other than lightning. This is consistent with the historical pattern.

Table 3 compares fire occurrence for 1988 with a management unit average. Each unit computed the average number of fires per year using a different time span. The figures were obtained from the unit's fire plan or through personal communication. The fire occurrence for 1988 was higher than average.

Table 3. Fire occurrence for 1988 and average occurrence. For administrative units within the Greater Yellowstone Area.

Unit	Annual average	Total fires in GYA 1988	Total fires for Park or Forest 1988
Beaverhead NF	16*	6	41
Bridger-Teton NF	60*	34	71
Custer NF (Beartooth RD)	7	11	11
Gallatin NF	25*	51	54
Grand Teton NP	9.5	19	19
Shoshone NF	25.5*	21	25
Targhee NF	24.4*	57	65
Yellowstone NP	29	50	50
Total		249	336

* The annual averages include fires that occurred outside of the GYA.

SECTION 6: DESCRIPTIONS OF MAJOR FIRES

This section provides narrative descriptions of major 1988 fires in the GYA. The descriptive chronologies provide the following kinds of information: date and source of ignition, location of fire, fire status (prescribed fire, wildlife), threat to structures, status changes and dates of changes, suppression stategies, major fire behavior, significant weather events, IC Teams in charge and dates teams changed. More detailed daily chronologies are provided in appendix C.

The information was primarily obtained from Incident Status Summaries (ICS Form 209), Escaped Fire Situation Analysis, fire narratives prepared by the Plans Section, and Daily Shift Plans. Where documentation was lacking on fire events and major decisions made, information was obtained from the people involved (I.C. Teams and National Park Service and Forest Service personnel)

Table 4 summarizes the major fires. Figure 11 shows fire growth for the major fires. Several of these were complexes comprised of two or more fires, and most burned on both National Forest and National Park lands.

Following is a brief chronology of each fire. These narratives highlight significant events and can be used in conjunction with the detailed chronologies in the appendix.

STORM CREEK

Lightning started the Storm Creek Fire (fig. 12) in the Absaroka-Beartooth Wilderness, Custer National Forest, on June 14, in the lower part of the Stillwater River drainage. The Forest Service detected the fire at 1800 on June 19. (An outfitter later reported that he had seen the fire on June 14.) A Wilderness Fire Management Incident Plan was completed that recommended that the fire be managed as a prescribed fire. The Custer National Forest Supervisor approved prescription status at 1000 on June 20. Concerns identified at the time were an unusually high ERC for mid-June, private residences, and the risk of smoke in the ventilation shafts of the Stillwater Mining Company in the vicinity of Nye, Mt.

Fire size for the period June 20 to July 1 was 125 acres. Fire made a major run to the north on July 2, moving 3-1/2 miles and growing to 2,400 acres. Fire was observed spotting 1/2 to 3/4 mile ahead of fire front under the influence of 40 miles per hour winds. On July 3, it was determined that the fire was a potential threat to private property and public safety and was declared a wildfire. Ron Curtiss's Type I Team took over the fire at 2200 on July 4. Following 6 days of suppression efforts, the fire was placed in confinement strategy and was turned back to the Ranger District on July 10 at 1200. The fire behavior specialist did not expect the fire to move to the south.

In mid-July the only visible smoke was a small spot in the rocks on the north side of Storm Creek. Putting the fire out was considered but it would have required technical rock climbers to reach the fire and it appeared there was very little chance of it spreading. The fire appeared to be essentially out.

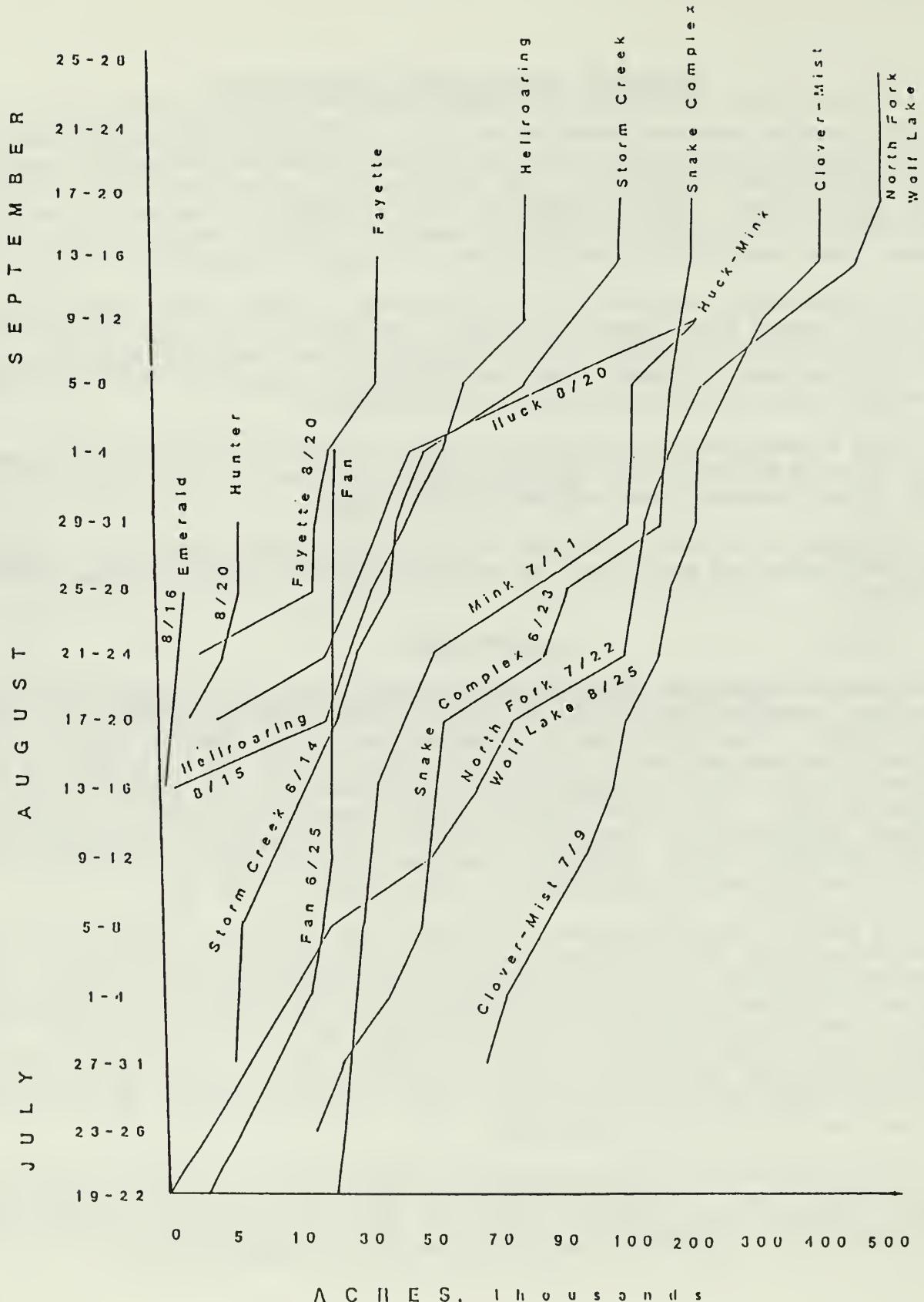


Figure 11. Growth of the major fires during the fire season including start dates.

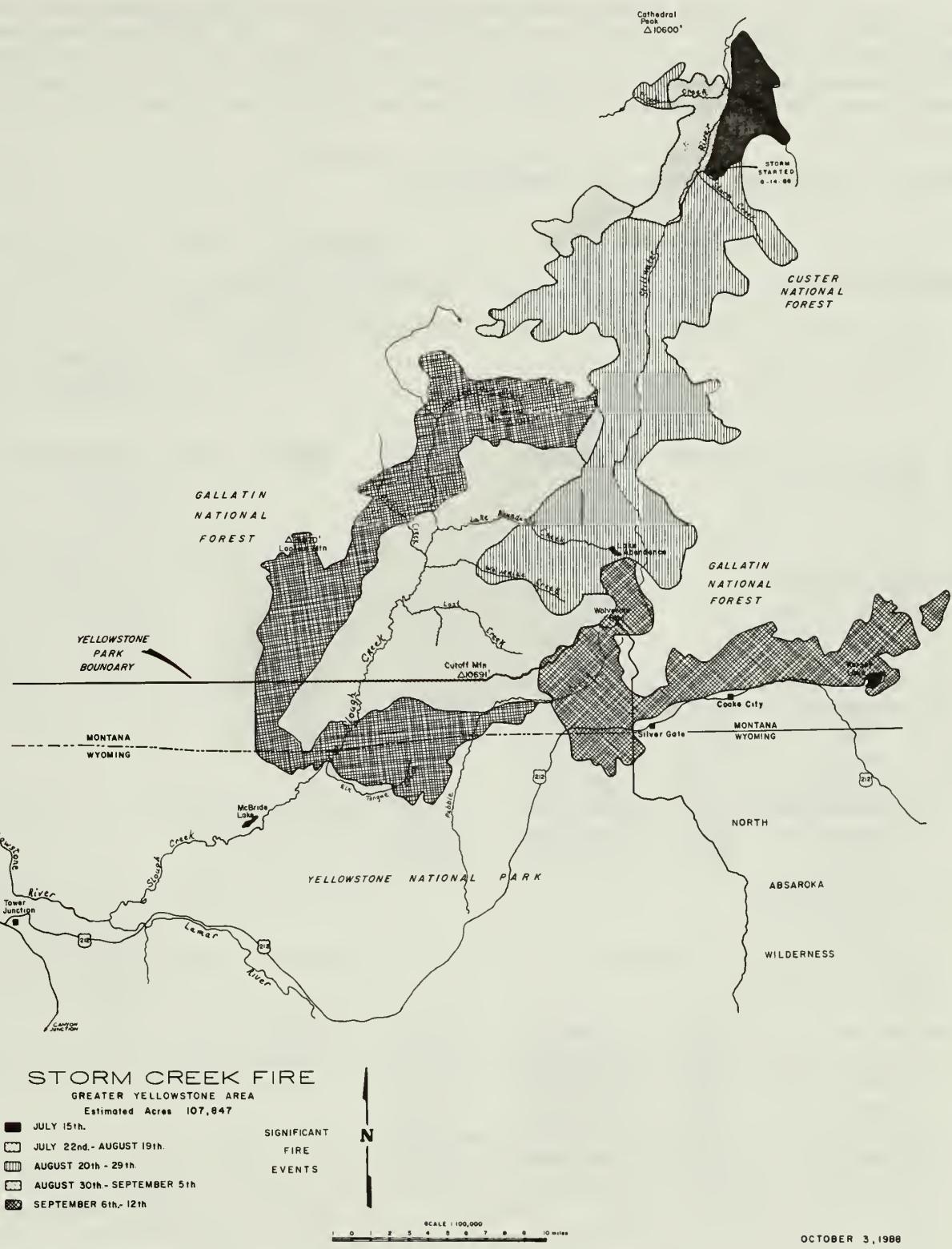


Figure 12. Storm Creek perimeter advance.

On July 20, a cold front moved through the area. A new lightning-caused fire was detected 7 miles south of the Storm Creek Fire. The fire was suppressed by smokejumpers at less than 1 acre. Fire also was detected near the Storm Creek Fire on the west side of the river. This increased activity was handled as part of the Storm Creek Fire. A 10-person District crew was dispatched to the north end of the activity.

Table 4. Chronology and status of major fires.

Name (Agency Origin)	Start	Cause	Fire type Prescribed wildfire		Status
1. Storm Creek (FS)	06/14	Lightning	06/20(FS)	07/03(FS) --(NPS)	107,847 acres contained; no control estimated
2. Fan (NPS)	06/25	Lightning	06/25	07/25	23,325 acres contained; control estimated 11/01
3. Snake Complex (NPS)					224,000 acres contained; control estimated 12/01
Shoshone	06/23	Lightning	06/23	07/21	
Red	07/01	Lightning	07/01	07/21	
Falls	07/12	Lightning	07/12	07/17	
Factory*	07/24	Lightning	07/24		
Continental*	07/29	Lightning	07/29		
Badger	08/01	Lightning	08/04		
Ridge*	08/04	Lightning	08/04		
4. Clover-Mist (NPS)					411,500 acres no estimate of containment or control
Mist	07/09	Lightning	07/09	07/21	
Clover	07/11	Lightning	07/11	07/21	
Raven	07/11	Lightning	07/11		
Lovely	07/20	Lightning	07/20		
Shallow*	07/31	Lightning	07/31		
Fern*	08/05	Lightning	08/05		
Sour*	08/27	Lightning	08/27		

(Continued)

Table 4. Chronology and status of major fires. (continued)

5. Huck/Mink (NPS and FS)					225,000 acres contained; controlled 11/15
Mink (FS)	07/11	Lightning	07/11(FS) 07/24(NPS)	07/14(FS) -- (NPS)	
Emerald (FS)	08/16	Lightning		08/16	
Huck (NPS)	08/20	Tree on Powerline		08/20	
6. North Fork/Wolf Lake (FS)					control 11/15
North Fork	07/22	Human		07/22	400,100 acres containment 10/17; control 11/13
Wolf Lake	08/25	Human		08/25	107,460 acres no estimate of containment or control
7. Hellroaring (FS)	08/15	Human	08/15(FS) 08/26(NPS)		81,950 acres contained; no estimate of control
8. Hunter (NPS)	08/20	Tree on Powerline		08/20	5,440 acres controlled 9/8
9. Fayette (FS)	08/21	Lightning		08/21	38,507 acres controlled 9/16
10. Corral Creek (FS)	08/29	Unknown	08/29(FS)		2,860 acres controlled 9/6

* Listed as prescribed on the fire log. Due to limited resources, fire crew safety, economic considerations, and higher suppression priorities, the decisions were to allow these fires to burn into the larger fires.

On July 21, the original EFSA was reviewed and modified to a 10,000 acre size under Alternative B. Amended size was based on predicted fire behavior, extremely steep rocky terrain in which the fire was burning, and consequent hazardous, high-cost construction of containment lines, and because of Wilderness values. The fire was expected to be confined on the west within the Stillwater drainage by the rocky ridges and, because of the generally down-canyon flow of winds and fuel configuration, to move 2 to 3

miles to the south along the western side of the valley. Crew activity contained the fire on the north, a backfire and containment lines between Cathedral Mountain and the river, and by barren rocky ridges between Flood Creek and the West Fork of the Stillwater River.

Between July 23 and August 18 the fire burned within the containment lines on the north and burned approximately 2 miles to the south within the confinement strategy. Fire activity August 9 to August 17 was minimal and trail closures were lifted on August 9.

On August 18, fire activity picked up again. Trails were again closed and crews dispatched to the area to protect trail bridges and assess the fire. On August 20 at 2030 strong up-canyon winds associated with a cold front moved the fire approximately 9 miles to the south in 4 hours. Jim Shell's Type II Team took over the fire on August 21, and a new EFSA was prepared with the objective of containing the fire to the Stillwater drainage.

Dave Liebersbach's Type I Team took the fire over on August 23. On August 26, the Sheriff's Office advised Cooke City residents that an evacuation could be called within 12 to 18 hours. A containment line was ordered between the Hellroaring Fire and the Storm Fire to stop all southern advance of the fire. A wind shift on August 31 blew the fire into Lost Creek, with heavy spotting all along the north side of the creek. The fire was "roaring like a freight train" in the Lost Creek drainage by 2300. The fire made a hard run on September 2, down Slough Creek towards Silver Tip Ranch. It also spilled over Wolverine Ridge and caused spot fires along Pebble Creek. Intense burning occurred on September 3, in Slough Creek, and 39 fire shelters were deployed by personnel protecting the Silver Tip Ranch. There were no injuries. No structures were lost at the ranch.

Evacuation of Silver Gate and Cooke City began at 0800 on September 4. A burnout operation from the dozer line west of Silver Gate started in mid-afternoon, on September 4, to prevent the main fire from running up Soda Butte Creek toward the towns of Silver Gate and Cooke City. At 1830 on September 6, an ember from the burnout started a spot fire behind the Range Rider in Silver Gate, got away and moved rapidly up-canyon. Crews were unsuccessful in catching the blaze, but managed to keep the fire outside the dozer line surrounding Silver Gate. High winds hit the fire on September 7, and accelerated its spread towards Cooke City.

Although structure protection crews worked hard to save most of the buildings in the Silver Gate, Cooke City, and Cooke Pass area, 10 dwellings, 13 sheds, and 1 television transmitter station were lost. A dense smoke cover from the North Fork and Wolf Lake Fires blanketed the area on September 10, slowing the rate of fire spread and allowing crews to begin mopping up in the vicinity of Silver Gate and Cooke City. Some light rain on September 10 and snow on September 11 also aided the mop up efforts. Liebersbach's Type I Team was demobilized from the Storm Creek Fire, and Jim Shells Type II Team took over the Fire on September 18. The fire was declared contained on September 17 at 107,847 acres.

FAN FIRE

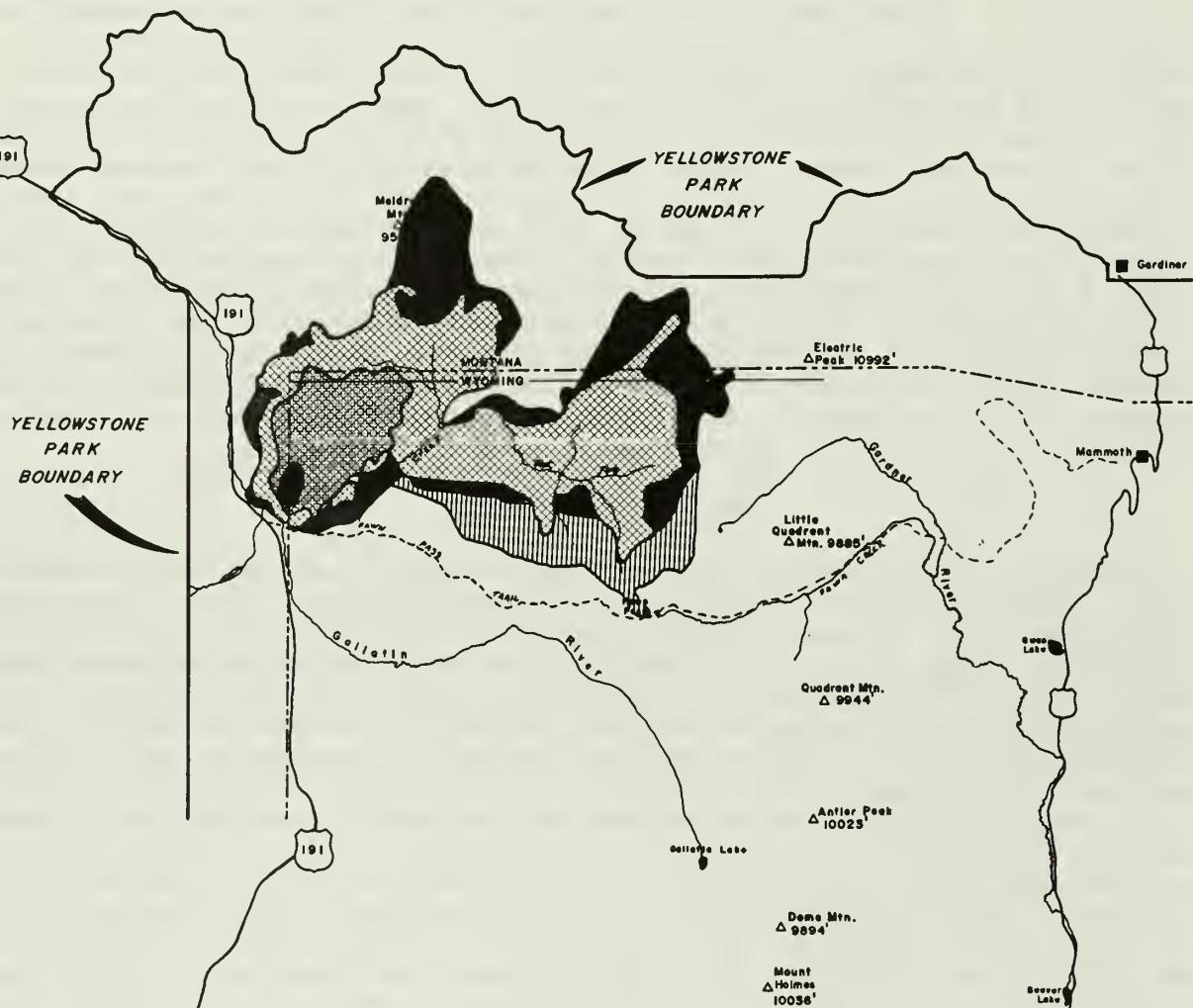
Lightning started the Fan Fire (fig. 13) on June 25, in Yellowstone National Park. It was declared a prescribed natural fire and was monitored by ground and air. On July 2, it made a run of 1,500 acres, driven by strong southwest winds. A rainstorm on July 4 slowed the spread, and it was inactive for the following week. When erratic winds caused spotting across the Fan Creek line (July 25), it was declared a wildfire at 3,500 acres and a Type II Team was ordered. Strong suppression efforts held it on the north Park boundary. The south flank burned into the 1979 fire, where young trees and less fuel reduced fire activity and enhanced control efforts. Fire activity accelerated because of strong, erratic winds between July 29 and August 2, causing an increase to 15,940 acres. Sportsman Lake patrol cabin was lost on August 2. Activity was minimal until mid-August, when winds and dryness increased. By the 22nd, the fire was 23,325 acres, where it remained until containment. Fire was demobilized on September 4 to a one-crew patrol and rehabilitation force. The North Fork Fire had a major northerly run on September 12 that was stopped by the Fan Fire.

SNAKE RIVER COMPLEX

The Snake River Complex (fig. 14) was designated on July 21 to include three lightning fires burning in Yellowstone National Park, south of Yellowstone Lake. It was ultimately comprised of the Shoshone, Red, Falls, Continental, Ridge, Factory, and Badger Fires which all began as prescribed natural fires in Yellowstone National Park. This paragraph describes the Complex; the subsections below describe the individual fires as they became part of the complex. A Type I Team was assigned to the Complex on July 23, with the Incident Command Post located at Grant Village. Protection of life and property was the primary objective, so great effort went into protecting developed areas with fuel modification and burnouts. Fires involved on this date were Shoshone, Red, and Falls. On July 24, the Factory Fire started, followed by the Continental Fire on July 29, the Badger Fire on August 1 and the Ridge Fire on August 4. Each became part of the Complex. On August 3, the incident was turned over to a Type II Team. The Shoshone Fire combined with the Red Fire on August 8. The Continental and Ridge Fires joined with Shoshone on August 19, and on August 24 the Falls Fire burned into the Complex. On August 25 the strategy changed to preventing spread to the north with a control line between West Thumb and Shoshone Lake. Remaining fire perimeter was to be contained, to prevent the Complex from threatening Old Faithful and joining the North Fork Fire. On August 29, the Mink Fire joined, and on September 8, the Snake River Complex merged with the Huck Fire. South and west park entrances were closed numerous times from July 25 to September 10, for public safety. To date, the Complex covers 224,000 acres, and is contained.

Shoshone Fire

This fire was started by lightning in Yellowstone National Park on June 23, south of Shoshone Lake, and burned with low activity for several weeks. It was initially declared a prescribed natural fire and monitored from the beginning by air and ground reconnaissance. On July 21, the fire was



OCTOBER 3, 1988

Figure 13. Fan perimeter advance.



SNAKE RIVER COMPLEX

GREATER YELLOWSTONE AREA

Estimated Acres 224,000

- JULY
- AUGUST
- SEPTEMBER

SIGNIFICANT
FIRE
EVENTS

1 0 1 2 3 4 5 6 7 8 9
SCALE 1:25,000

N

OCTOBER 3, 1988

Figure 14. Snake River Complex perimeter advance.

declared a wildfire; protection of life and property was the main objective. On July 22, it grew from 160 to 1000 acres during extreme burning conditions, and the next day, it grew to 4,500 acres. Grant Village was evacuated July 23. By July 25 the fire was 9,000 acres. Fire came from the west into the Grant Village area on July 25, and the Grant Village/West Thumb developments were successfully protected. Strong southwest winds on August 1 increased the fire to 16,100 acres. Shoshone combined with the Red Fire about August 8. The Continental and Ridge Fires merged with the Red and Shoshone August 19.

Red Fire

The Red Fire started by lightning on July 1 on the southwest side of Lewis Lake, was declared a prescribed natural fire. For the first 20 days, it was monitored by air and ground, as it grew to 1,000 acres. It was declared a wildfire on July 21 when it threatened Lewis Lake Campground, and was put in the Snake River Complex. Winds pushed fire southeast around the lake on July 23, causing a major run east across the highway that forced evacuation of the campground and closed the south entrance road. It was now 2,800 acres. Protection of life and property had priority, so strong control efforts were used to protect the campground and entrance roads with firelines and burnouts. Fire to the east of the south entrance road burned under a confinement strategy with the objective to keep it in the Park. Spotting produced spread on many days. A major run to the northeast occurred on July 25, burning nearly 7,000 acres and advancing 4 miles in as many hours. The crown fire had 150-foot flames. Acreage was about 10,500 and subsequent extreme conditions increased it to 20,300 acres on August 7. Red and Shoshone Fires combined on August 8.

Falls Fire

This lightning fire started in the Park on July 12 1 mile north of the Targhee National Forest boundary. It was declared a prescribed fire. Suppression was ordered for the south flank on July 17, while the north portion remained a prescribed natural fire. The fire was declared a wildfire on July 21. Crews built firelines starting July 17 and backfired to hold the handlines on the NPS/FS boundary from July 20 to July 22. Strong winds on July 23 and 24 increased the size from 385 to 2,200 acres. During the following days, fire behavior was quiet until gusty winds on August 7 caused a slopover, on the west flank, which was contained. A hail storm cooled the fire on August 13. The north flank combined with the Snake River Complex on August 25, when the Falls Fire was about 3,800 acres.

Factory Fire

This fire, of undetermined origin, started July 24, on Factory Hill. It was in the Snake River Complex and initially listed as a prescribed fire. The decision was to let it burn as part of the complex because suppression would be hazardous and futile with three other large fires burning nearby. It was recognized the Factory Fire would join the main complex in a short time. No information is available about fire behavior or size when it joined with other fires.

Continental Fire

This lightning fire started July 29. Due to its proximity to the Red and Shoshone Fires, it was initially declared a prescribed fire. The initial strategy was to allow it to burn, monitoring it by air, recognizing that it would eventually be burned over by the Red and Shoshone Fires. On July 30, the decision was made to attempt to contain the south flank, using natural barriers and direct attack line construction. This action was intended to keep the fire from spreading further to the south. One crew was sent in by boat on July 31. By August 1, the fire escaped containment efforts and was allowed to burn until engulfed by the Red and Shoshone Fires on August 22.

Badger Fire

This lightning fire started August 1, in the vicinity of Badger Creek. Records show that it burned out at less than 1 acre. The Badger Fire joined with the Red-Shoshone Fire on or about August 19.

Ridge Fire

Lightning started the Ridge Fire on August 4, one mile west of Yellowstone Lake, just south of the Continental Fire. Due to close proximity of the Ridge Fire start to the Red, Shoshone, and Continental Fires, the Ridge Fire was listed as prescribed, and the decision was made to allow it to burn into the larger fires.

CLOVER-MIST FIRE

The Clover-Mist Fire (fig. 15) was designated on July 23 from several lightning fires in northeastern Yellowstone National Park. It was comprised of Mist, Clover, Raven, Lovely, Shallow, Fern, and Sour Fires which all began as prescribed natural fires in Yellowstone National Park.

The Raven Fire started July 11 and the Lovely on July 20. Both fires were west of the Mist Fire. Following extreme weather conditions, the Forest advised the Park on July 21 it did not want responsibility for the Clover-Mist Fires. On that date, they became wildfires, with suppression on the south and east flanks, to keep them within the Park. On July 22, they burned together, covering 31,500 acres. A Type I Team was called in on July 23 and in place the next day. Strong winds and extreme weather increased the size to 46,825 acres on July 26 and to 68,035 acres by July 28. The latter included a slopover of 1,175 acres in the Shoshone National Forest. The Shallow Fire was found on July 31 at 100+ acres. Suppression actions were effective on the south flank, and the fire was turned back to the Park on August 4.

Shallow and Fern Fires combined into Clover-Mist on August 11. Lovely Fire joined on August 21. An 11-mile run, driven by the August 20 wind event, added 46,500 acres (170,700 acres total), and caused fires to spot across eastern passes into the Shoshone N.F. A replacement Type I Team was on line August 21. Frontal winds with gusts 50 to 70 miles per hour on

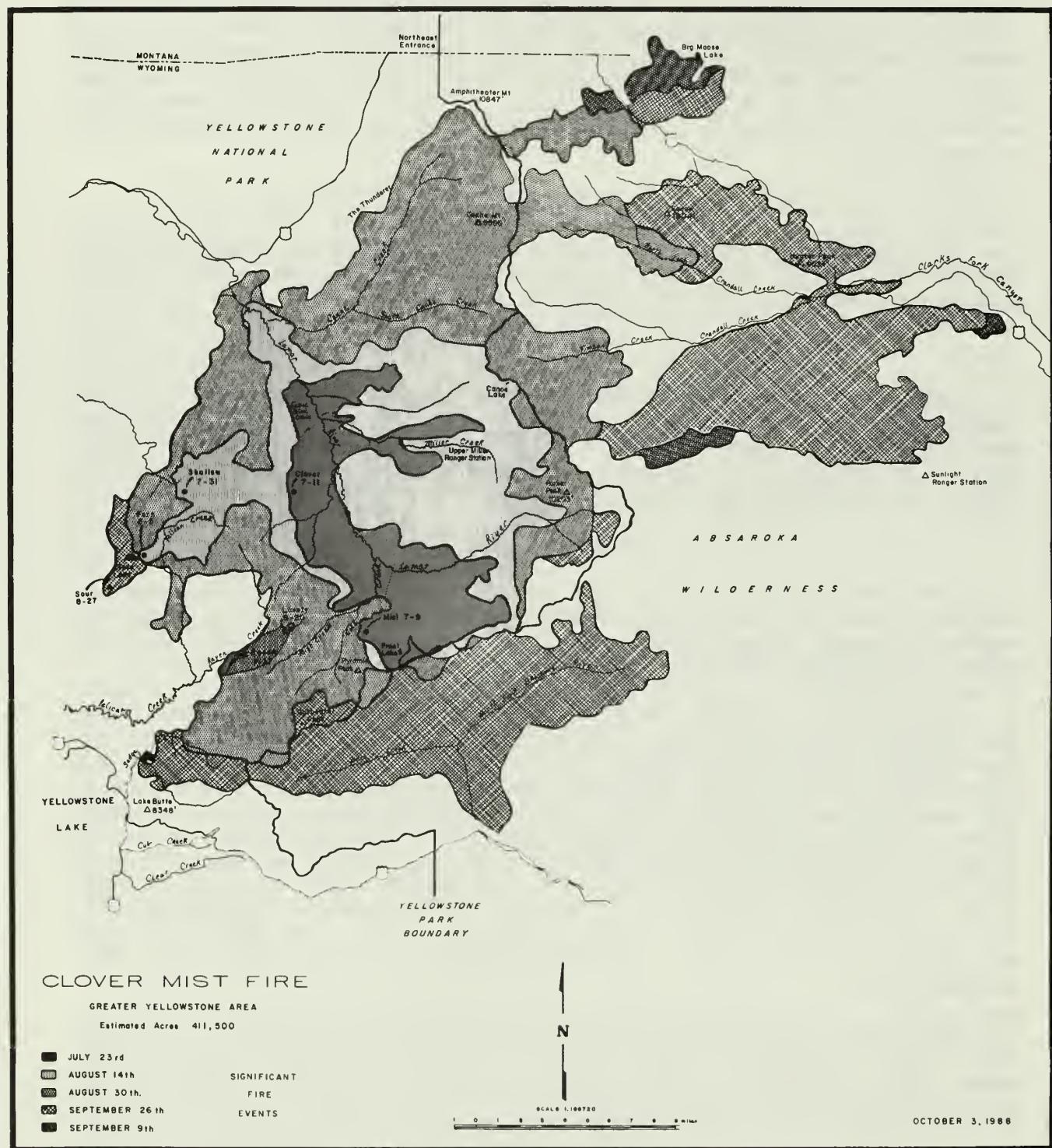


Figure 15. Clover Mist perimeter advance.

September 8 and September 9 developed into terrain channelled downslope winds that affected fires burning in Sunlight, North Crandall, Jones Creek, Papoose, and Squaw Creek drainages. Wind-driven fire consumed structures around Crandall. Damage reported to date include 17 trailers, 5 residences, 3 outbuildings, 1 store, 2 vehicles, and 2 boats. Snow began falling on the high elevations on September 9 and 10. Four to six inches accumulated on the highest peaks by September 13. Demobilization of the Type I Team occurred for September 17, with a reorganization to two Type II Teams. Clover-Mist Fires cover 411,500 acres, with no estimate of containment or control.

Mist Fire

The Mist Fire started on July 9 by lightning and was called a prescribed natural fire. The Mist Fire grew to about 2,000 acres during strong winds of July 13 to 21. It became a wildfire when suppression was ordered on July 21. The south flank generated the greatest concern because it moved close to the wilderness lands of Shoshone National Forest. Mist combined with Clover on July 22. The southwest flank of fire burned on to Shoshone N.F. lands on upper Bear Creek, and westward in the Park, into Pelican Valley, northeast of Yellowstone Lake. A major run September 6 spread easterly, down Jones Creek, threatening Pahaska Tepee area on the Shoshone N.F.

Clover Fire

The Clover Fire started July 11 by lightning and was called a prescribed natural fire. It grew rapidly. The first major run on July 14 prompted emergency protection of backcountry cabins. Firefighters deployed fire shelters at Calfee Creek Patrol Cabin. There were no injuries and the cabin was saved. By July 15, Clover was 4,700 acres. Large acreage in the Lamar River drainage burned during the next two weeks, reaching 10,700 acres. Other cabins were protected, and none were lost. Clover combined with Mist July 22.

Raven Fire

This lightning fire started July 11 and was called a prescribed natural fire. It stayed about 60 acres until July 29, when extreme weather conditions caused it to join the Lovely Fire for a total of 1,145 acres. The noted winds of August 20 pushed these joint fires into the Clover-Mist Fire by the next day.

Lovely Fire

Lightning started this prescribed natural fire on July 20. Within a couple of days, it grew to 35 acres. It remained small until activity increased, and it joined the Raven on July 29. Both became part of the Clover-Mist on August 21.

Shallow Fire

Shallow was started by lightning, and was found July 31 at 100+ acres. It doubled in size the next day. Winds in mid-August drove it northeast. By August 12, it was 2,763 acres, and joined the Clover-Mist Fire the next day.

Fern Fire

This fire was started by lightning on August 5 and was listed as a prescribed fire, but immediate action was taken to protect a nearby cabin. The decision was made to allow this fire to burn into the adjacent Shallow Fire.

Sour Fire

This lightning fire started on August 27 and was initially listed as a prescribed fire, but due to its proximity to the Shallow and Fern Fires, the decision was made to allow it to burn into them.

HUCK-MINK COMPLEX

Mink Fire

Lightning started the Mink Fire on July 11, (fig. 16) in the Mink Creek drainage, within the Teton Wilderness area, administered by the Bridger-Teton National Forest. The fire was within the guidelines established by the Teton Wilderness Fire Management Plan. It burned an estimated 25-30 acres by the evening of July 12, and was monitored, but not manned. The fire burned vigorously through July 14 and monitoring continued. At this time, the Bridger-Teton Management Team reassessed the fire situation. The fire was within prescription, but due to the fire behavior and extremely dry conditions, it was declared a wildfire. The fire had burned to the east and south and had burned patches of a 15,000-acre blowdown that had resulted from a July 1987 tornado.

On July 15, an EFSA was completed and the selected strategy was to contain the fire on the south flank to reduce the risk of the fire spreading into a major concentration of blowdown timber. A confine/contain strategy was adopted for the remainder of the fire. Dale Jarrell's Type I Team was assigned to the fire by midnight, the fire was 9,130 acres.

Between July 15 and 18, fire behavior was very active, due to extremely low fuel moistures and moderately strong afternoon winds. Fire spread was generally to the north and northeast, from Enos Lake, and primarily due to excessive torching and spotting up to 1/2 mile. In an area of the blowdown, the fire generated convection columns that rose 16,000 to 17,000 feet. On the evening of July 18, fire size was estimated at 14,040 acres.

On July 19, the Superintendent of Yellowstone National Park agreed to take the fire if it came into the Park. Based on information conveyed by

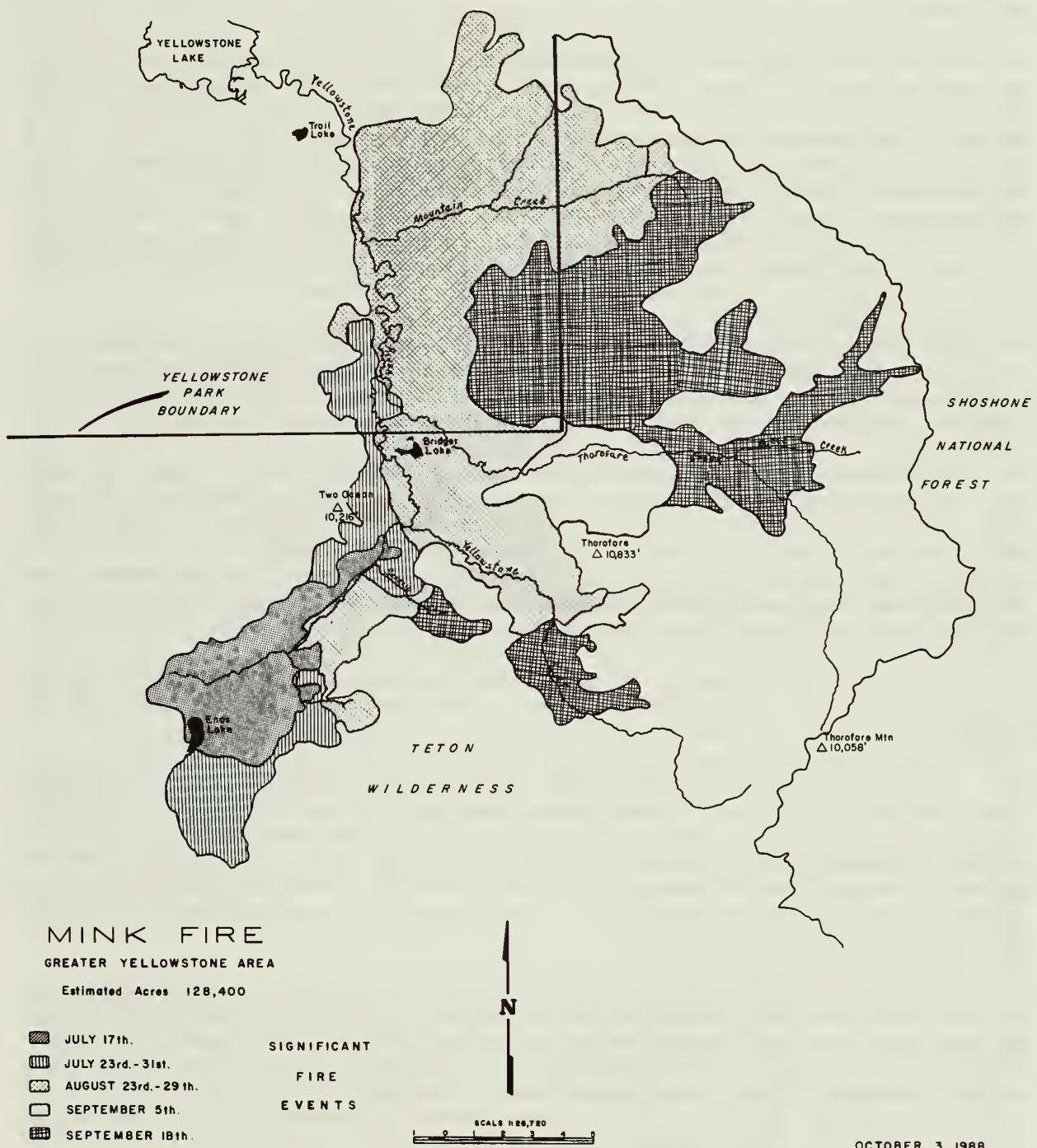


Figure 16. Mink perimeter advance.

fire behavior specialists, the decision was made to protect Yellowstone Meadows and continue containment efforts on the south flank. Fire was active on the south end and spread over the established natural fire break, bringing the fire size to 14,847 acres. An amendment was made, on July 20, to the EFSA that included the protection of Yellowstone Meadows as a second priority.

Extreme burning conditions existed on July 20. The Operations Section determined that a large (900 acres) burnout would be necessary to halt spread of the fire through the blowdown. The burnout was ignited at 1610, using a helitorch. Extreme heat built rapidly and within 8 minutes a convection column approaching 30,000 feet was observed from base camp. Most of the energy was released from this burnout within one hour and all containment lines held. Success of the operation was phenomenal, considering estimated fuel loads of 300+ tons per acre in the blowdown and very dry conditions. The fire reached 17,100 acres and became the largest fire ever recorded on the Bridger-Teton National Forest.

The time between July 21 and July 26, was a period of extreme fire behavior. The south flank was held successfully and efforts increased on the north flank as the fire spread toward Yellowstone National Park. Flame lengths were reported at 150 to 200 feet above the canopy on July 22.

On July 24, the fire entered Yellowstone National Park. Also, on this day, an amendment to the EFSA was made to include Falcon Creek and the west side of The Yellowstone River in the containment objectives. During the next two days, active burning continued in the vicinity of Falcon Creek drainage on both National Forest and National Park lands. On the evening of July 26, the fire was 90 percent contained within the Bridger-Teton National Forest and was a total of 24,680 acres.

On July 29, Jarrell's Type I Team achieved 100 percent confine/containment and a transition to Comb's Team was completed on July 30 at 1800.

In early August (8/1-8/3) most of the fire activity occurred in the Park, while the National Forest side remained quiet. On August 3, Combs' Team presented GYAC a contingency plan to allow for some control action to stop the southerly spread of fire on the east side of The Yellowstone River. The effort was designed to keep the fire from leaving Yellowstone National Park and proceeding up the Thorofare drainage back onto the Bridger-Teton National Forest.

A transition from Combs' team to Turner's team occurred on August 10 and 11. Little fire activity occurred on National Forest lands but the fire increased on the Park lands in the vicinity of Howell and Mountain Creeks. High winds on August 15 increased fire activity on several creeks and the cabin in Howell Creek was threatened. The Emerald fire was started by lightning August 16, and Turner's team agreed to assist District personnel from the Mink Incident Command Post. Fire was active on National Park lands through the 17th of August. The Bridger-Teton National Forest Fire

Management Officer conveyed to Turner's Team on August 17 that the Forest Supervisor wanted the fire suppressed if it crossed back onto the forest.

Jarrell's Class I team took command of the Mink and Emerald fires on August 19. On August 20 high winds shut down air operations and the Mink fire was reported to be across the Yellowstone Meadows and burning above the Hawks Rest cabin. The Huck Fire started in Grand Teton National Park and burned onto The Bridger-Teton National Forest, and Jarrell's team agreed to take command of it.

On August 21, the Mink Fire was across Yellowstone Meadows and into the Thorofare Drainage. Priorities of the Incident Command shifted to protect structures on Huck, to hold the Emerald and to lend a crew for structure protection to the Hunter Fire. Mink was unmanned from August 21 through August 23. Suppression actions were limited due to smoke inversion and higher suppression priorities while the fire burned actively.

On August 25 the helitack crew at the Wyoming Fish and Game Department cabin was threatened by fire. The crew moved into a wet meadow, deployed their shelters and escaped injury. The situation on the Mink Fire was reevaluated and control measures were reactivated with 25 crews ordered. The strategy was to contain the fire in the Thorofare drainage. McAtee's Team took command of the incident on August 27, but higher priority fires led to a delay for the initiation of control actions. Hawks Rest Cabin had helitack crews remaining to protect it and work spots. Otherwise, the Mink Fire remained unmanned.

On August 29, the Red-Shoshone Fire from the west merged with the Mink Fire at Badger Creek. For the next two days fire spread was eastward and high fire danger continued with strong winds. On August 31, the helitack crews worked to protect Fox Park Patrol Cabin. Fire size was at 115,900 acres.

An inversion decreased fire activity on September 1. The strategy was to prevent fire from moving up the Yellowstone River with the objective of keeping the fire from burning onto the Shoshone National Forest. The inversion continued through midday September 5.

The most active fire was in Pass and Silvertip Creeks from September 5 through September 9. The plan was to tie the east flank of Huck into the west flank of Mink.

On September 9 Gallegos' team took over the 128,400 acre fire at 1200. As of September 11, The Huck and Mink Fires were managed as one incident. Work progressed on the Huck Fire through September 15 when 100 percent containment was reached as line on the south flank was tied into the Mink Fire. Greenhoe's Type II team took over at 0900 on September 16. Snow fell over most of the burn on September 18. On September 21, the Ranger District took charge of the fire.

Emerald Fire

The Emerald Fire started by lightning near Emerald Lake on the Bridger-Teton N.F. on August 16, 1988, and was classified as a wildfire (fig. 17). Jarrell's IC Team on the Mink Fire agreed to support IC George Jackson on the Emerald Fire from the Mink Base Camp. The extreme fire situation locally and regionally was considered, and a containment strategy was selected at 1000 on August 17. Consideration of potential loss of outfitter revenue, possible disruption to fall hunters, and air quality impacts on the Jackson Hole and Cody areas were addressed. Fire size was at 130 acres. The main objectives were to protect improvements north of the fire, to keep fire from spreading into Yellowstone National Park, and gain control of the fire with minimum acres burned, using natural fire barriers and light hand on the land tactics.

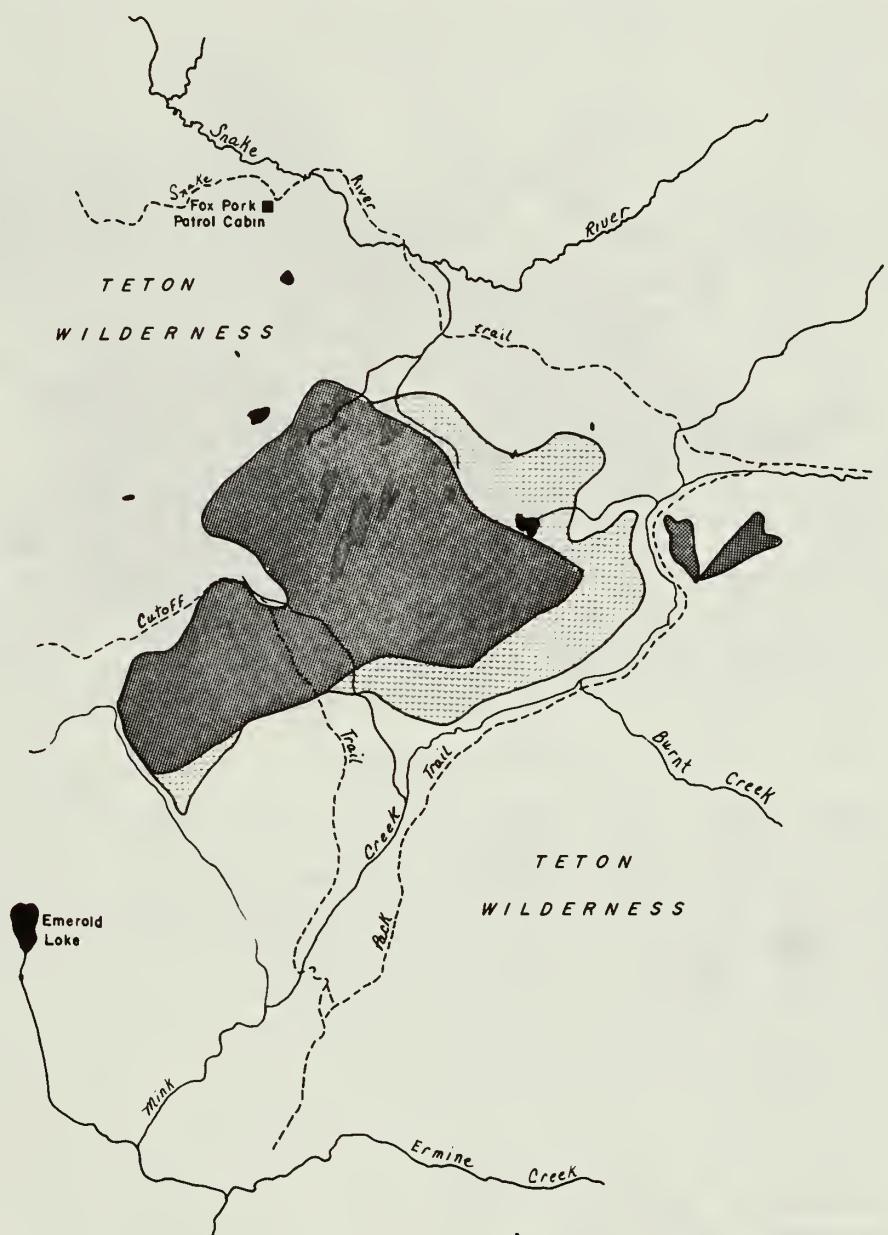
Jarrell's Type I Team officially took over command of the incident on August 19. On that day, the fire became active, retardant was not available and the size grew to 875 acres. Pushed by winds on August 20, the fire was across Mink Creek and increased to 1,200 acres. Many spots out in front of the main fire were apparent on August 21, but water and retardant drops were effective. Fire behavior over most of the fire was not significant over the next several days. On August 25, 100 percent containment was achieved. The Emerald Fire was controlled at 1800 hours on August 28 at a size of 1,520 acres.

Huck Fire

A tree across a power line started the Huck Fire on August 20, (fig. 18) on the J.D. Rockefeller Jr. Parkway, administered by Grand Teton National Park. The Fire was classified as a wildfire and made an immediate run that threatened Flagg Ranch, requiring evacuation. Additionally, Highway 89/287 was closed and Lizard Creek Campground was evacuated. The fire crossed the highway and burned onto the Bridger-Teton National Forest, increasing to 4,000 acres in 2 hours. At 1700, Grand Teton National Park officials requested Jarrell's Type I Team on the Mink Fire to take over the Huck Fire. They agreed. The Snake River Campground and Flagg Ranch were secured. The strategy was to control the fire west of the highway, protect structures, and provide safety for the highway.

The fire burned east and northeast over the next several days. By August 24, at 1800 hours, two heads had formed and the fire was in excess of 15,000 acres. On August 25, the two heads on the east side had burned together and size of the fire was estimated at 21,500 acres. The fire spotted up to 3/4 mile on August 26. On this day, 5 crews totaling 120 people evacuated Bailey Meadows Spike Camp on foot. Fire size was 30,000 acres. On August 30, a cold front with southwest winds of 15 to 25 miles per hour produced very extreme fire behavior with long-range spotting. The fire made a major run across Colter Creek, near the saddle at the head of Pilgrim Creek, for a distance of approximately 5 miles. Another head at the northeast corner of the fire ran northeast into Yellowstone National Park and across the Snake River. The fire increased 10,200 acres, to bring the total acreage to 42,300 acres. No established line was lost. On August 31,

YELLOWSTONE NATIONAL PARK



EMERALD FIRE

GREATER YELLOWSTONE AREA

Estimated Acres 1,520

■ AUGUST 20th.

■ AUGUST 21st.

SIGNIFICANT

FIRE

EVENTS

SCALE 1:24000

N

OCTOBER 3, 1988

Figure 17. Emerald perimeter advance.

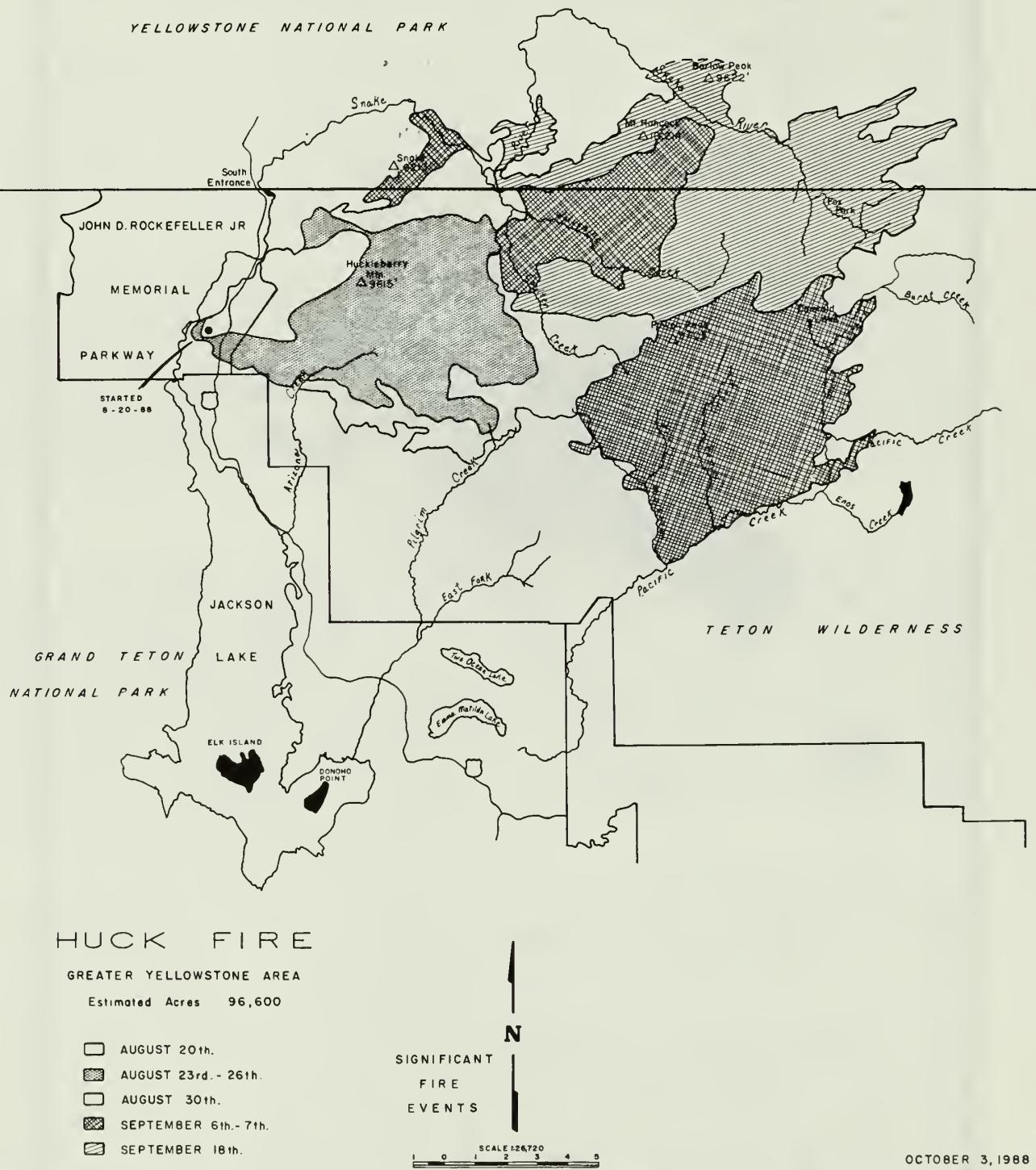


Figure 18. Huck perimeter advance.

extreme fire weather continued, but an inversion between September 1 and 5 resulted in little active fire behavior.

By midday on September 5, the inversion lifted and the fire became very active, spreading to the east-southeast. Camp personnel and crews on Division F were evacuated safely. Increased winds from a cold front on September 6 caused extreme fire behavior, which continued through September 7. A successful burnout was executed between Gravel and Whetstone Creeks, in support of strategy to prevent southerly spread. The Red-Shoshone Fire merged with the Huck Fire from the north on September 8. Steve Gallegos' Type I Team took command of the fire on September 9 and a structural protection plan was written for the Buffalo River Valley in the event that fire could not be contained in the vicinity of Pacific Creek. A light rain on September 10 and snow on September 11 began a cooling period and as of September 12, the Huck and Mink Fires were managed as one incident. Greenhoe's Type II Team took over at 0900 on September 16 and heavy snow fell on September 18. The fire was officially turned over to the Bridger-Teton National Forest at 0800 on September 21.

NORTH FORK/WOLF LAKE FIRES

Due to its large size, the North Fork Fire (fig. 19) was divided into two incident commands on August 25. The fire was about 40 miles long and 104,000 acres, which made it difficult to manage as one fire. The Wolf Lake Fire was the northeast portion, approximately north of Gibbon Falls. The North Fork was to the south, west, and north of this point. At this time, (Oct. 12) North Fork is 400,000 acres, with containment estimated by October 17 and control by November 13. For the Wolf Lake Fire, acreage is 107,460, with no estimated containment or control.

North Fork Fire

This was a human-caused wildfire on July 22, which began a short distance from the Park boundary on the Targhee National Forest, and escaped initial attack. The west flank was contained, but strong winds (25 to 40 miles per hour) spread it rapidly into the Park. By night, it was estimated at 340 acres. Smokejumpers were unable to parachute to the fire due to high winds. On July 23, it was mapped 4 miles inside the Park. The Type I Team arrived and was briefed that evening. On July 24, because of the major run, protection of structures was initiated at Old Faithful Village, which was about 12 miles from the origin. A containment strategy was used on the west and northwest, with the main suppression focus for protecting Old Faithful Village with fuel reduction and firelines. On July 26, the fire had moved 6 miles into the Park towards the village. On July 27, the size was 8,500 acres. Cooling temperatures facilitated direct attack for two days. Strong winds on July 30 pushed the fire to 11,300 acres. Based on information from a team of national experts in fire behavior, the strong suppression focus remained to the northeast, east, and southeast. Containment strategy was used for the west and north flanks.

A burnout was set on August 5 to reduce fuels in a 3-mile swath of blowdown. Major runs occurred on August 11 and 12, causing a growth to

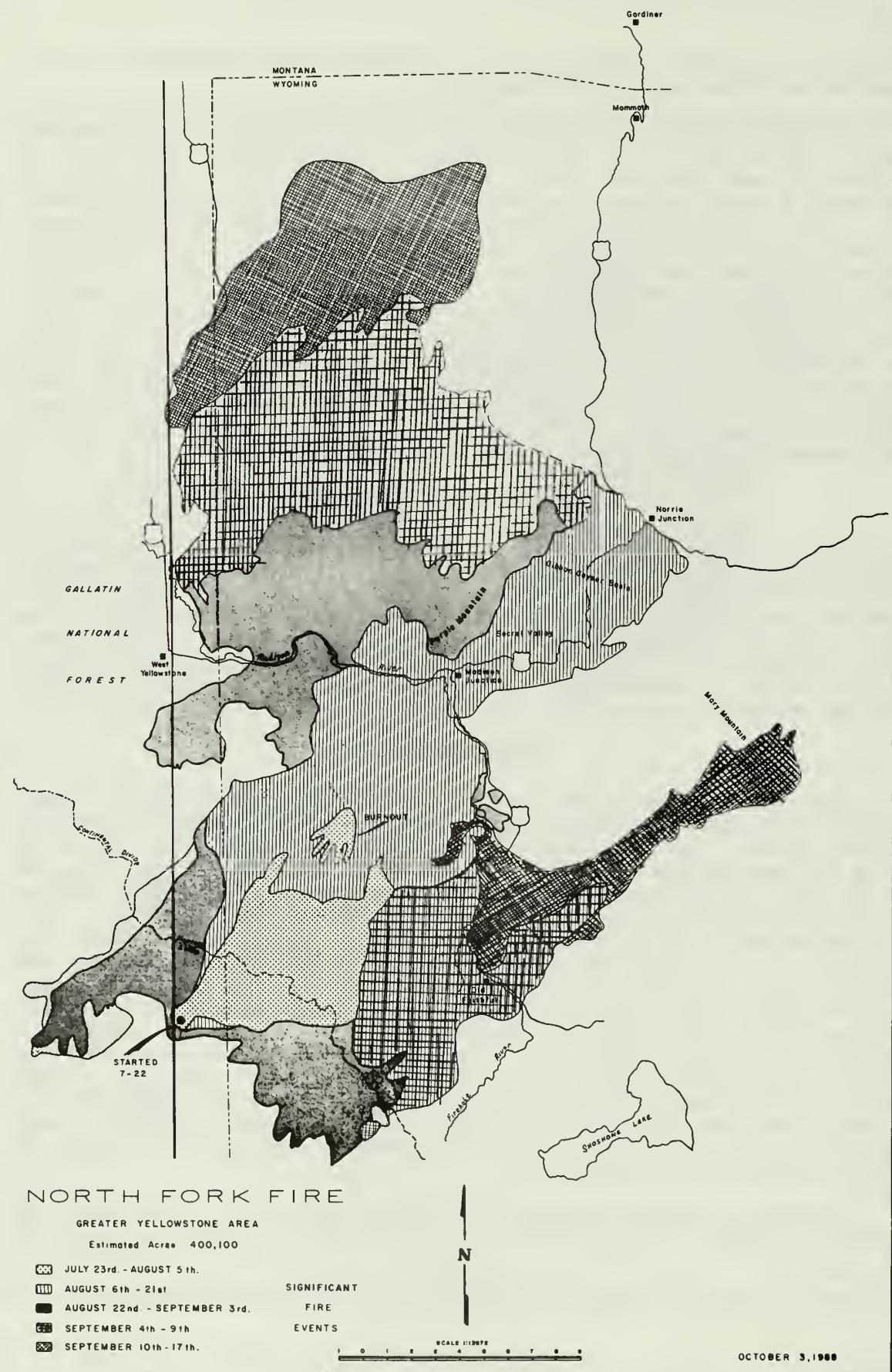


Figure 19. North Fork perimeter advance.

34,120 acres. When fire spotted across Firehole River, the Madison-Old Faithful road was closed. Winds on August 15 pushed fire across Madison Junction, but no buildings were lost in the campground or housing areas. Norris campground was evacuated on August 17, and the Norris-Madison road was closed. Structural protection occurred at Norris on August 18, while the fire grew to 69,000 acres. The next day, it was 72,410 acres. Winds to 40 miles per hour on August 20 caused a major northeasterly fire run. The fire split into two heads, one north and the other south of Norris Junction. At this time, the fire was divided into two commands on August 25, with the acreage of North Fork reduced to 77,800. Northerly winds up to 20 miles per hour caused slopovers on August 27, renewing the threat to Old Faithful and the Moose Creek Resource Natural Area, Targhee National Forest. Army forces were placed on the fireline. Old Faithful and West Yellowstone continued to be threatened during the following days. Acreage was 117,400 on September 1.

The North Fork fire burned downslope threatening West Yellowstone the same day, jumping the West entrance road and Madison River. Bulldozers and handcrews constructed firelines and fuel breaks to protect the town. Smoke hampered air operations. Large capacity sprinkler systems were installed on the south and east sides of town and at Old Faithfull Village. A slopover on the southwest flank occurred on September 2 and 3, into the National Forest along the perimeter that was contained July 23.

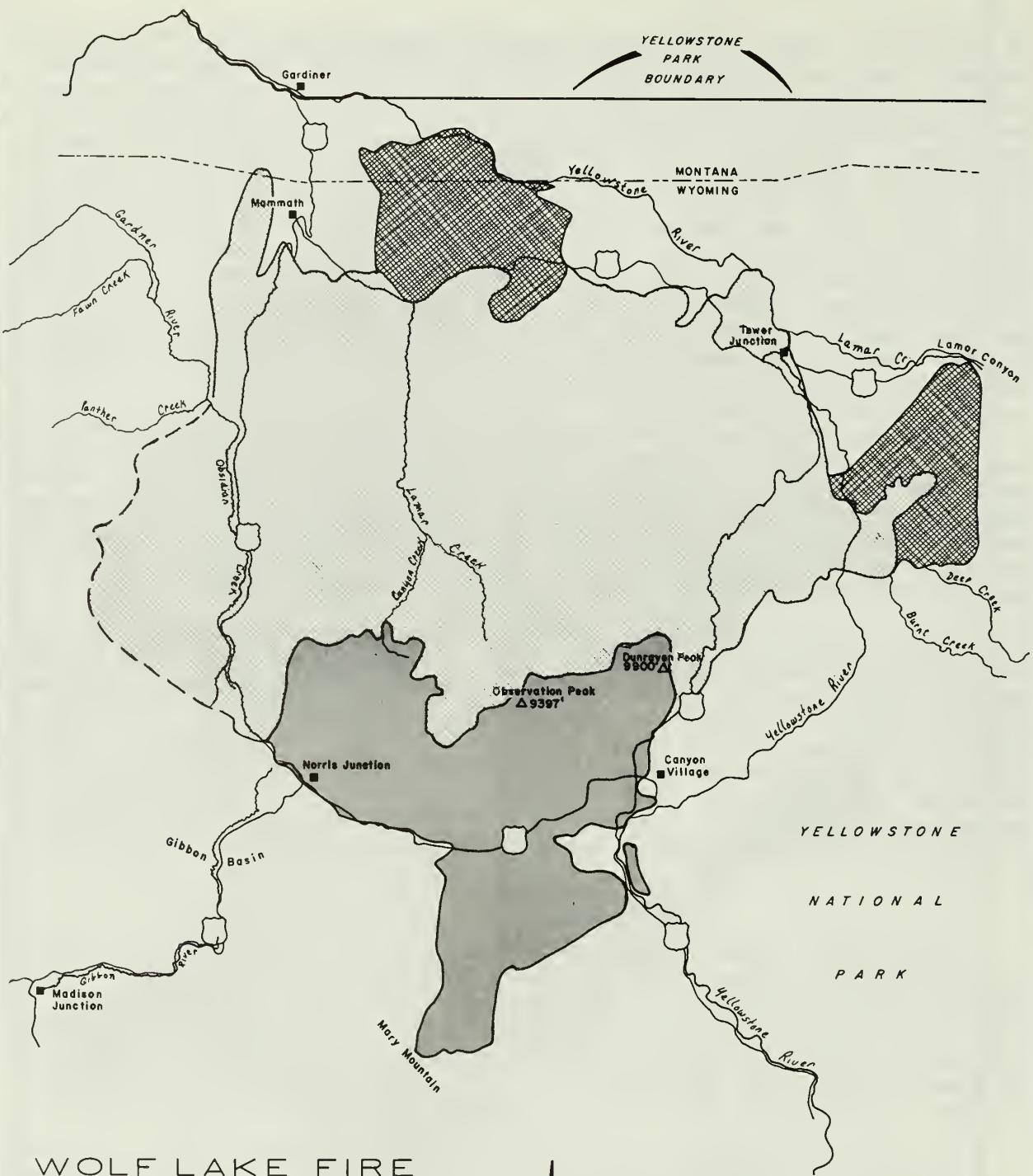
Winds picked up fire activity on the north and southeast flanks of the North Fork Fire during September 6. Fire advanced to within 1 mile of Old Faithful development by the evening of September 6. Strong winds continued through the night and day of September 7, advancing fire on all fronts. Winds to 50 miles per hour drove fire to Old Faithful on September 7. Some evacuation was completed before the fire overran the village. No injuries occurred. The northwest flank joined with the Fan Fire on September 10. Damage reported to date: 19 cabins, 2 dorm rooms, 3 storage/shop buildings, a restroom, 5 vehicles, 1 water tank, and a television transmitter station.

Wolf Lake

With a Type I Team in command, the Wolf Lake Fire, at 30,000 acres, was administratively divided from the North Fork Fire on August 25 (fig. 20). Canyon Village protection continued with extensive hazard fuel reduction. A 100 acre spotfire between Chittenden Bridge and Alum Creek, across Yellowstone River, was contained on September 1. Preplanning for protection of Lake Village was implemented. Strong winds increased fire activity. Military crews were on the fireline holding the southern flank.

The wind of September 8 and 9 drove the north flank of the Wolf Lake fire across the Yellowstone River to Specimen Ridge and over the Tower Junction development. Structural protection the night of September 9 was effective, with no structures lost. A sprinkler system installed around the Tower development was used.

The fire advanced to within 1 mile of the Mammoth Hotsprings developed area September 9. The Governor of Wyoming sent 6 engine task forces to Mammoth for structural protection, which arrived in the morning of September



WOLF LAKE FIRE

GREATER YELLOWSTONE AREA

Estimated Acres 107,460

- AUGUST 22nd. - SEPTEMBER 3rd.
- SEPTEMBER 4th.- 9th.
- ▨ SEPTEMBER 10th.- 17th.

N

SCALE 1:12672

1 0 1 2 3 4 5 6 7 8 9 miles

OCTOBER 3, 1968

Figure 20. Wolf Lake perimeter advance.

9. The fire was stopped at the YCC Camp on September 10 by a sprinkler system, engine companies, and hand crews. The fire crossed Undine Falls and reached the Yellowstone River by sundown on September 10.

Very light snow and rain (0.03 inches) fell on September 11 and (0.01 inches) September 13. Since September 14, handcrews and tactical air support were working to isolate and confine the most threatening concentrations of heat along the vast, open perimeter. A battalion of Marines provided support. Fire activity was minimal with the advent of cooler temperatures, precipitation, and higher humidities.

Following the cooler weather in mid-September, fire activity decreased. The return of high pressure systems caused activity along the northeast flanks.

HELLROARING FIRE

The Hellroaring Fire started near an outfitter's camp in Beaver Creek, Gallatin National Forest, on August 15 (fig. 21). Immediate suppression action was initiated. This wildfire had burned 120 acres by the end of the day under conditions of low relative humidities and gusty southwest winds. The fire spotted ahead of the main front 1/4 to 3/4 of a mile on August 19, and burned a total of 5,700 acres for the day. A major fire run occurred in the Hellroaring drainage on August 20, and the convection column reached an altitude of 27,000 feet MSL. The fire was estimated to have sustained a rate of spread of 1 mile per hour for 8 hours. Winds were estimated to be gusting to 60 miles per hour, with sustained winds of 25 to 30 miles per hour at base camp. The Bull Moose cabin was destroyed and the fire grew 14,000 acres during the day. Total fire size on August 20 was 22,000 acres.

On August 26, the fire burned south across the Yellowstone National Park boundary on the west side of Buffalo Fork. Total size of the fire was 34,200 acres. A dry Pacific cold front on August 30 brought winds of 15 to 20 miles per hour, with gusts to 30 miles per hour. Spotting occurred regularly at distances 1/4 mile ahead of the fire front. Total fire size was 39,200 acres by the end of the day.

Torching and sustained crowning on September 7 forced crews to abandon firelines they had constructed over the past several days northwest of Buffalo Butte in the head of Beaver Creek. Total fire size by the end of September 1 was 49,800 acres. An aerial burnout operation on September 7-8, on the Buffalo Plateau, increased the fire size by another 20,000 acres. A run from the Wolf Lake Fire bumped near the Hellroaring Fire, south of Slough Creek, on September 9.

It started snowing lightly about 0730 on September 11, and the fire was officially declared contained at 1800, with acreage estimated at 81,950.



Figure 21. Hellroaring perimeter advance.

HUNTER FIRE

On August 20, at approximately 1400 hours, a severe wind storm blew a green aspen tree down over a powerline and ignited a fire approximately 250 meters northeast of the Aspen Ridge Ranch building in Grand Teton National Park. At 1405, the Hunter Fire (fig. 22) was reported to Grand Teton N.P. dispatch. Initial attack at 1415 was made by Grand Teton National Park engines and personnel. The fire was approximately 15 acres at the time of initial attack. Pushed by high winds, the fire advanced rapidly onto the Bridger-Teton National Forest, with significant spotting occurring. A Type I Incident Management Team was requested by the park at 1500. By 2030, the fire was estimated at 2,000 acres. Numerous homes, Teton Science School, Lost Creek Ranch, Hunter Ranch, Triangle X Ranch, and Schweiring Studio were threatened by the fire. National Park Service personnel provided structure protection with engines from Moose (N.P.S.), Moran and Jackson Fire Departments, 4 water tenders, bulldozers and airtankers.

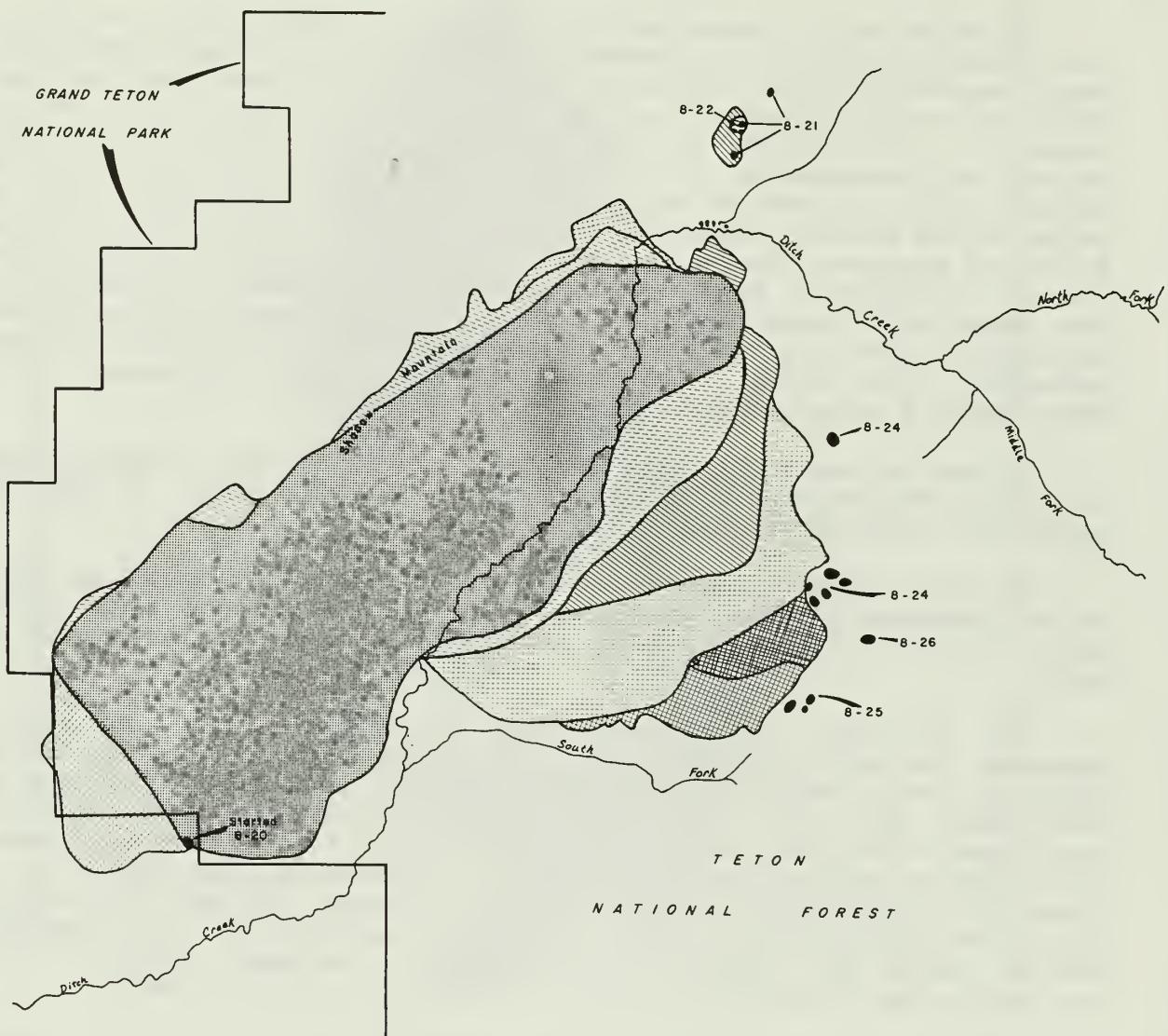
At 0600 on August 21, Gollaher's Type I Team took over. During August 21 and 22, the fire made no major runs due to decreased winds. At 1800 on August 22, estimated size was 4400 acres.

Increased temperatures and southwest winds of 7 to 14 miles per hour, on the afternoon of August 23 caused active runs on the east flank of the fire. Excellent progress on line construction and burnout operations was made.

Over the next 2 days, inversions kept fire activity low in the mornings. As the inversion broke on August 24, a major run over the line on the east side of Ditch Creek occurred. At 1800, approximately 300 acres of the slopover was unlined. Two airtankers assisted during the day. The fire was active most of the night, with torching until after midnight. Severe fire behavior occurred again the following afternoon (August 25). As the inversion lifted, spotting occurred up to 1/2 mile over the line, due to fire runs through dense stands of unburned subalpine fir and Engelmann spruce, within the fireline. Fire spread in a northeast direction. The west and northwest perimeters of the fire were in a mop up situation.

Strong northerly winds of 20 to 30 miles per hour on August 26, caused a 5-acre slopover in the South Fork Drainage. Crews were mopping this up by 1800. Northerly winds continued throughout the night, causing flare-ups and bringing dense smoke from the Huck and Mink Fires. A heavy inversion on August 27 kept fire activity low and at 1800, the Hunter Fire was 100 percent contained. Total fire size was 5,440 acres.

mop up operations continued through August 30, with one spot over the line and runs in the unburned fuels within the perimeter of the fire. Smith's Type II Team assumed control of the incident at 1000 on August 30. Objectives continued to emphasize mop up with assistance from infrared flights to identify hotspots. Low fire activity continued for the most part through September 9, and good progress was made on mop up. The fire was turned over to the Bridger-Teton N.F. at 0900 on September 9.



HUNTER FIRE

GREATER YELLOWSTONE AREA

Estimated Acres 5,440

- AUGUST 21st.
- AUGUST 22nd.
- AUGUST 23rd.
- AUGUST 24th.
- AUGUST 25th.
- AUGUST 26th.

SIGNIFICANT
FIRE
EVENTS

N

SCALE 1:24,000

OCTOBER 3, 1988

Figure 22. Hunter perimeter advance.

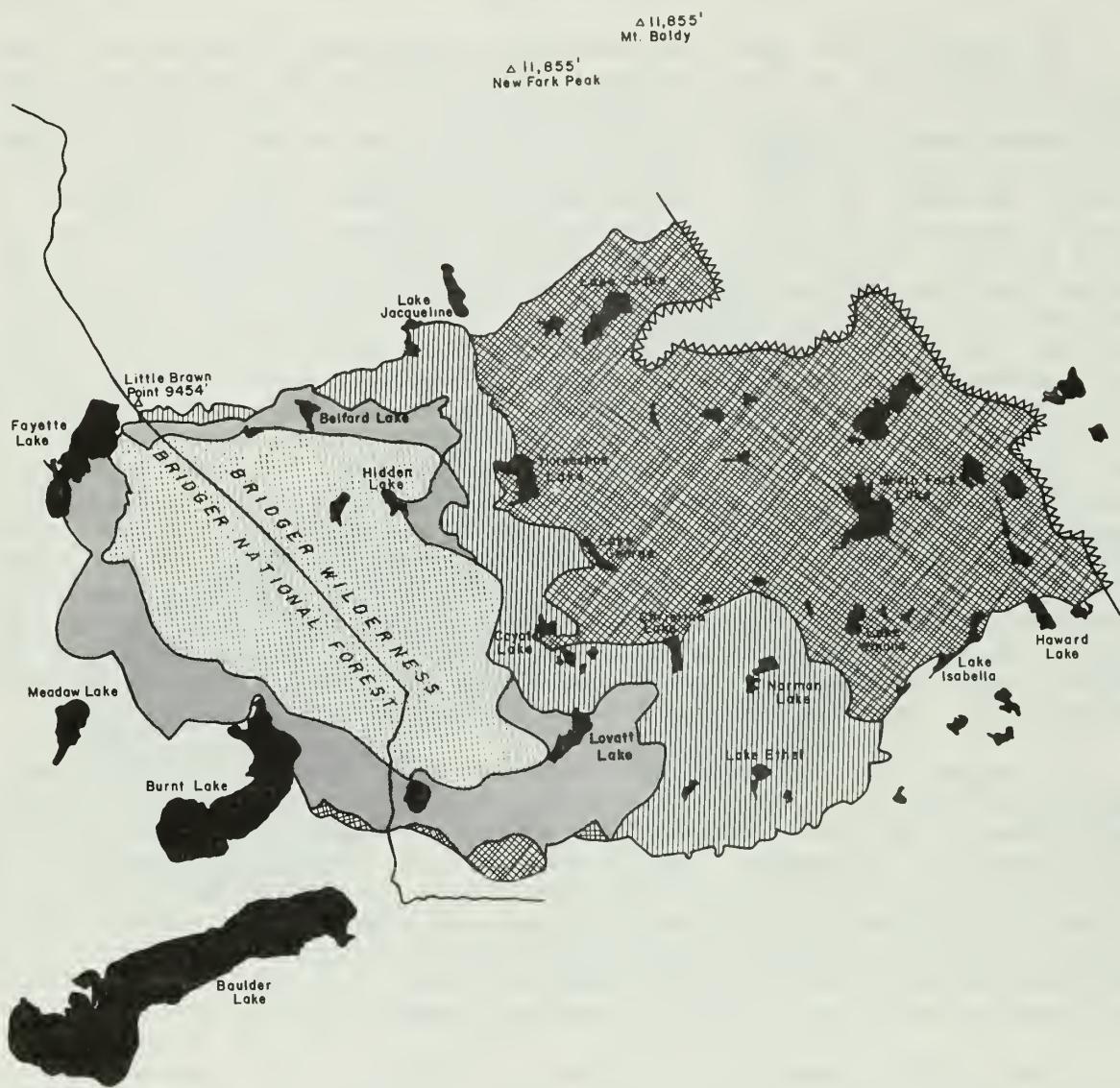
FAYETTE

The Fayette Fire (fig. 23) started by lightning on August 21, 1988, near Fayette Lake, on the Pinedale Ranger District of the Bridger-Teton National Forest. The fire was reported at 1700, and initial attack was made by 6 smokejumpers at 2022. The EFSA called for control outside the Bridger Wilderness and containment inside the Wilderness. Steep terrain, dense timber, extremely dry fuels, and severe spotting made control difficult. A Type II team was requested on the afternoon of August 22. The fire was 200 acres in size. Shive's Type II Team assumed command on August 23. The fire spread into the Bridger Wilderness and made a major run on August 24, overrunning a spike camp. No injuries occurred, but government and personal gear was lost. The fire size was 2,650 acres at the end of the day. Major runs occurred again on August 25, with approximately 5,000 acres burned by 1000, and an additional 5,000 acres burned by 2200. Most of the spread was into the Bridger Wilderness, but some southerly spread threatened a pack station and the resort and subdivision at Boulder Lake. The strategy was to construct dozer line along the west flank and turn the fire's head eastward, toward the Wilderness, to avoid structures at Boulder Lake. Several other major runs occurred on August 26. Three airtankers were used to reduce spread toward the Boulder Lake subdivision. Thirty-five structures were threatened. The following day, the fire was not as active, making only minor advances. Five airtankers worked to delay the fire's spread in the Boulder Creek drainage. The transition to Bryant's Type I Team was complete on August 28. The fire was 15,045 acres by that evening.

On August 30, the Wyoming National Guard arrived to assist with suppression efforts. Extremely erratic, high winds on August 31 caused major runs to the east. Complexities of the fire dictated a need for long range planning. September 1 was another day of extreme fire behavior and rapid rates of spread, most of which were due to spotting. The fire reached a size of 20,020 acres. Fire activity remained high for the next 2 days and nights. Helicopter support aided significantly in suppression of spot fires on September 4. Advancing fire thwarted direct line construction efforts and three crews were cut off from Horseshoe Camp for several hours.

A cold front passage on September 5 resulted in fire spread down to Boulder Creek, while firelines held along the north flank and northeast corner. Line construction and burnout operations continued through September 6. Strong winds resulted in major runs on September 7, and prevented major progress toward containment of the fire. The fire overran a major portion of the handlines on the east side pushed fire to the northeast. The slopover in Boulder Creek doubled in size, but direction of spread was away from private property. An evening planning session resulted in a change of tactics from direct attack to indirect attack with burnout operations aimed at running the fire into the rocks below the Continental Divide.

West to southwest winds on September 8 made the burnout operations a success. Approximately 2.8 miles of burning was completed between 1300 and 1900. At Skinner's Camp, line was improved and mop up progressed. In other areas, numerous spot fires were attacked to maintain lines in Boulder and



FAYETTE FIRE

GREATER YELLOWSTONE AREA

Estimated Acres 38,507

- AUGUST 23rd - 25th
- AUGUST 26th - 28th
- AUGUST 31st - SEPTEMBER 5th
- SEPTEMBER 6th - 10th
- ▲▲▲▲ TREE LINE

SIGNIFICANT
FIRE
EVENTS

N

SCALE 1:62500

0 1 2 3 4 miles

OCTOBER 3, 1988

Figure 23. Fayette perimeter advance.

Pipestone Creeks. mop up and holding actions were successful through September 9.

Cold weather with rain and wind supported mop up and holding actions on September 10. On the same day, a person-caused fire approximately 2 acres in size, named Big Sandy, 20 miles south of the Pinedale Airport, was initial attacked using water bucket drops from the large S-64 helicopter.

mop up was favorable September 11 and 12, due to continuing cold weather. An additional fire (lightning holdover) 6 miles north of the Pinedale Airport was initial attacked with the 212 helicopter water bucket drops. The District monitored this fire. The Fayette Fire was turned over to the Forest on September 14.

CORRAL CREEK FIRE

The Corral Creek Fire (fig. 24) started on August 29 to the west of the Lee Metcalf Wilderness in the Beaverhead National Forest. The cause was a campfire. This fire was immediately declared a wildfire, and it had the potential to become another major fire in the GYA. Clay Gregory's overhead team was called in to manage the fire suppression efforts. The fire threatened ranches and resort structures and had grown to 2,600 acres by August 31. Although this was a small fire, it was significant in that resources were pulled off other larger fires in the GYA in order to suppress it and to protect structures. At this time, the strategy for the major GYA fires was confinement/containment, with emphasis on protection of structures and improvements. The loss of a few resources to Corral Creek did not seriously impact these efforts, and Corral Creek was controlled at minimal acreage with no structures lost. The fire was declared controlled on September 6 at 2,860 acres.

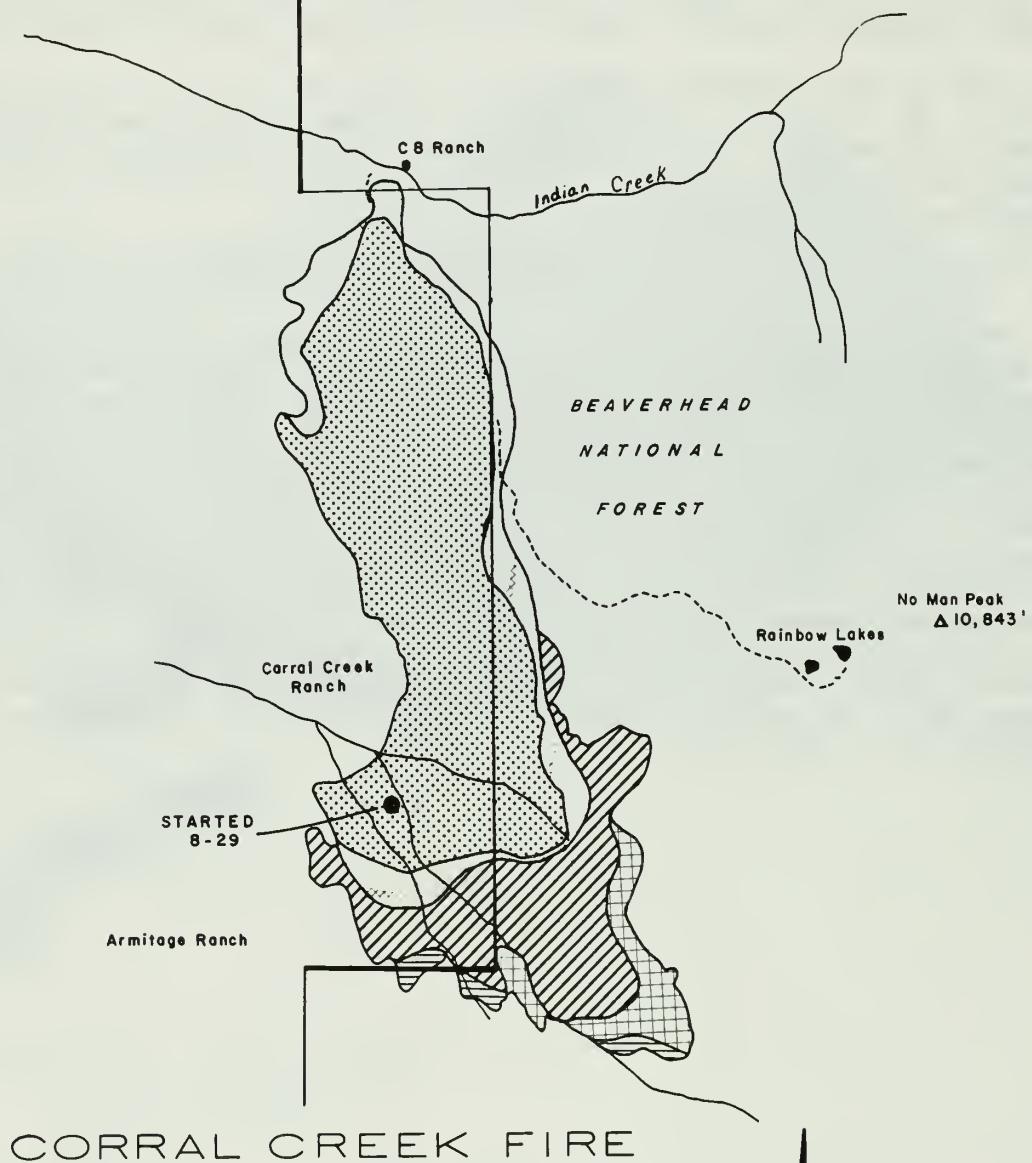


Figure 24. Corral Creek perimeter advance.

SECTION 7: FIRE SUPPRESSION STRATEGY AND TACTICS

STRATEGY

Several prescribed fires in the Greater Yellowstone Area exceeded prescription criteria during July. The decision was made to handle these fires as wildfires (control, contain, or confine). Other fires that started during July and August were immediately classified as wildfires and quickly grew to large size due to the drought conditions and strong winds. Multiple large fires produced a situation so complex that priorities had to be set for allocating scarce suppression resources. An Area Command was established in West Yellowstone July 23 to set priorities and to coordinate fire suppression actions throughout the Greater Yellowstone Area. At, this time, the superintendent of Yellowstone Park delegated fire management authority to Incident Commanders.

Traditional perimeter control strategies using direct and indirect attack were implemented at the outset. Control strategy is the most aggressive suppression option and involves the completion of a control line around the fire, any associated spot fires and any interior unburned islands to be saved. It also includes burning out on the fire side of the control line and cooling all hot spots that immediately threaten the line. Contain strategy includes surrounding the fire and any associated spots with control line tying this into existing human-made natural barriers. Confining a fire restricts the fire's spread to within boundaries established either prior to or during the fire. Both confine and contain strategies reduce the cost of suppression efforts.

On July 28, the first meeting was held by line officers (Forest Supervisors, Park Superintendents, and the Regional Director), Area Commanders, and Incident Commanders to affirm strategies. The IC's presented the alternative strategies for each fire in the GYA and gave their recommendations, which were endorsed by the group.

Line Officers and Incident Commanders again met with Area Command on August 2 to review fire behavior projections and fire strategy alternatives to determine the appropriate suppression response to the multitude of fires. Because protection of life and property was the top priority, direction was given to concentrate control effects around developed areas using fuel reduction and structural protection. Confining and contain strategies were then selected for dealing with perimeter spread.

Safety concerns, direct attack being infeasible, and lack of suppression resources precluded total control strategy on the many miles of fireline.

In the case of Old Faithful Village, three strategies were proposed. One strategy was to use contain/confine strategies (\$500,000) on all perimeters. However, fire was projected to reach Old Faithful in 2 to 5 days. The second strategy was to use control strategy on the south and east flank using blackline, burnouts, and hand lines (\$2 million). Contain/confine would be used on the north and west boundaries. The third

strategy was to take direct attack on all perimeters. A safety note stated that 2 to 3 lives would likely be lost and that firefighters could not catch the fire because of extreme behavior.

Similar decisions for the blend of control and confine/contain strategies were made on other fires, i.e., protection of Canyon Village on Wolf Lake Fire, and Cooke City on Storm Creek Fire. Following a meeting between Line Officers and Area Command in West Yellowstone on August 7, it was determined that Area Command would remain to coordinate all fire activities, and that current strategies were the best and most reasonable alternatives.

At a West Yellowstone meeting on August 26 of Line Officers, Area Command, Incident Commanders, and representatives from the Boise Interagency Fire Center (BIFC), it was decided that the Greater Yellowstone Area would be divided into northwest, northeast, and south zones for strategy purposes. BIFC requested at this meeting that Area Command release 50 crews, helicopters, one infrared aircraft, and other resources to priority fires outside the Greater Yellowstone Area. Declining fire suppression resources, coupled with a continuation of severe fire behavior, made it difficult to maintain perimeter control strategies on the Greater Yellowstone Area fire complex. Thus, a transition began towards protecting life and property, concentrating suppression resources in developed areas. Private properties were prioritized by proximity to the closest fire threats. In summary, overall objectives from the August 26 meeting included: defend what had been held (Fan, Hunter, Emerald Fires); identify, prioritize, and protect improvements and structures; and develop exterior containment boundaries.

Area Command placed a great emphasis on the suppression of new fires and on August 30, assumed the suppression responsibility for the Corral Creek Fire on the Beaverhead National Forest. Suppression resources were diverted from the Greater Yellowstone Area to the Corral Creek Fire, and it was controlled at a small size. Area Command also assigned a Zone Coordinator on August 30 to deal with fire suppression issues on all Greater Yellowstone Area fires south of Yellowstone National Park's south boundary.

Line Officers for the Greater Yellowstone Area and Area Command met in Bozeman, MT, on September 4 to review the fire situation and strategy alternatives. The Area Commanders highlighted the failure of traditional perimeter fire control strategies. High-intensity fires characterized by routine torching, crowning, and spotting easily crossed handlines, dozer lines, major highways, the Madison River, and Yellowstone Canyon. The Area Commanders stressed the importance of a more complete transition from perimeter control to the protection of life and property. The Line Officers reaffirmed the delegation of authority, the emphasis on protection of developed areas, and the strategy of indirect perimeter control.

Area Commanders met with Incident Commanders at Grant Village on September 11 and directed a strategy shift to perimeter control at the exterior of the fire complex, to take advantage of the first real break in the weather since the fire season began. Precipitation, higher humidities, cloud cover, and lower winds on most of the Greater Yellowstone Area from September 11 to September 25 favored successful direct attack and mop up for the first time in weeks.

TACTICS

Much of the fires in the GYA burned in National Park and National Forest Wilderness lands, where managers have sought to allow a full range of natural processes and disturbances to occur. Many of the agency fire management plans provide specific policy and guidelines to minimize the extent and impact of traditional fire suppression practices. For example, in Absaroka-Beartooth Wilderness, "use of powersaws and other motorized equipment must be approved by the Forest Supervisor" or in some cases, the District Ranger. Grand Teton National Park requires the Superintendent's approval for use of heavy equipment. Yellowstone National Park limits use of dozers to protection of life and property, with approval of the Superintendent and Regional Director. Contingency plans were drawn up for use of dozers within Wilderness on at least the Fayette Fire and on the Huck-Mink fire, incorporating considerations to minimize impacts. Dozers were authorized for use in the North Absaroka Wilderness on the Clover-Mist fire but use was kept to a minimum. Use of powersaws and helicopters was also minimized and many supplies were packed in by stock. Dozers and loaders were used for fuel reduction within developed areas on many of the fires.

Many of the fire management plans provide guidelines for "light-hand on the land" suppression tactics, and light-hand tactics were incorporated into many suppression plans and daily shift plans. Light-hand guidelines include suggestions to minimize impact of fire camps and spike camps; selection of helispots to minimize construction and visibility to high visitor-use areas; locate control lines to take advantage of natural barriers and light fuels; minimize intensive line construction, including use of cold-trailing, burning out, and hose lays, bucket drops, and retardant drops; minimize cutting of snags and logs, including cutting stumps flush with the ground; rehabilitation and construction of drains and water bars on constructed line; and minimize soil disturbance in mop up.

Several plans recommend use of water in place of phosphate-base aerial retardants, particularly near streams and fisheries. Some fire management plans, such as Grand Teton National Park's, prohibit seeding of burns, recognizing that natural seeding and resprouting can be delayed by introduction of the aggressive, non-native grasses commonly used.

Both direct and indirect attack suppression tactics were employed, using handlines, dozer lines, burnouts, coldtrailing, natural barriers, fireline explosives, water, helibuckets, and retardant. Although there were some successes in building and holding line, severe drought conditions combined with high winds of cold front passages caused most fires to overrun

firelines sooner or later. At one point on the Greater Yellowstone Area, 400 miles of fireline had been constructed and only 20 miles held.

Torching, crowning, and short-to-long range spotting produced fire behavior that was extremely difficult to contain under prevailing conditions. Extensive green islands within firelines continued torching and spotting even where firelines could be burned-out and held. Fires burned as well during the night as in the daytime, because moisture content of fuels always was below the moisture of extinction. Since falling snags posed a continual hazard to fire crews, fire fighting at night usually was not attempted (four firefighters were hit by falling trees on the Snake Complex Fires alone). The absence of night crews made it difficult to hold fireline that had been constructed during the day. Torchng and spotting often foiled attempts at burning-out. Successful burnouts often required extensive limbing and fuel modifications, extensive bucket drops, retardant drops, and hose lays, and long delays waiting for diminished winds and higher humidities. Attempts at night burning were hampered by poor recovery of fuel moisture and continued extreme fire behavior, difficulty in detecting spot fires, and lack of air support.

During major fire runs, suppression efforts often concentrated on protecting structures and developed areas. Intensive fuel reduction was carried out with saw teams, hand crews, and heavy equipment, including limbing trees, felling snags, hauling, piling, and burning slash, and burning out perimeters. Water was used extensively, including dozens of engines, hose lays and pumping systems, extensive sprinkler systems, and bucket and retardant drops.

One outstanding success was holding the Fan Fire to the relatively small size of 23,000 acres. The Fan Fire included elevations up to 10,000 feet, where cooler temperatures, rocky areas with sparse fuels, and a mosaic of some recent fires retarded fire spread. In addition some 3.1 million gallons of water were dropped on the Fan Fire from nearby sources. Over 300,000 gallons of water were dropped on the Fan Fire on one day alone. All cold-trailed line ultimately had to be handlined and hotspotted between August 14 and September 22, before it would hold.

Extreme fire behavior in the form of intense spotting, where nearby every firebrand seemed to become a spot fire, also contributed to a difficult control situation. A typical example of fire behavior defying an excellent control effort occurred during an attempt to burn out a buffer strip along the highway between Norris Junction and Canyon in late August. The operation was well equipped to ignite and control this burnout--two Boeing Vertol helicopters with buckets working in tandem, at least one strike team each of highly trained and experienced crews equipped with fire engines on flat ground in relatively light lodgepole pine fuels. No direct flame crossed the highway, but hundreds of hot embers were lofted across the road, landing on unburned fuels. As night approached and an inversion of smoke covered the area, it became more difficult to detect the smoldering spots. By early afternoon of the next day, two major spot fires had developed, both burning 1/4 to a 1/2 mile away from the original burnout. Handcrews dug line, helicopters dumped water, and hoselays were strung from the fire

engines, but the spot fires, creating their own spot fires, became impossible to control, soon engulfing hundreds of acres.

Some burnout attempts proved more successful. On the west flank of the Hellroaring Fire a burnout operation was called "picture perfect" in its first phase and was completed successfully, although the Wolf Lake Fire ran into the burnout boundary. A burnout plan was written describing the ignition prescription, objectives of the burn, and assignments for preparation. The plan called for handline preparation along trails, water backup, preparation of cabins and other structures, hourly weather readings for spot forecasts, and air support arrangements. The burnout was postponed one day due to erratic winds. The ignition proceeded the following day, September 7, with aerial ignition from the interior with a helitorch. The fire ignited easily and carried rapidly into the crowns, with very little difficulty experience in holding the lines. One spot over a line was rapidly controlled by hand crews before helicopters could reach it with a water bucket. Hand ignitions completed the burnout once heavy smoke from southern fires stopped use of the helitorch. Favorable winds from the southwest were primarily responsible for the operations success. The need to complete the burnout before major wind changes was recognized.

FIREFIGHTER SAFETY

Concern for personnel safety is part of all strategy and tactical decisions. There were no fireline fatalities or serious injuries on the GYA fires, prior to October. In early October, there was one fatality and one serious injury resulting from falling snags. This is a remarkable record considering that suppression continued more than 3 months with a peak of some 9,500 people and 117 aircraft, working in strong, erratic winds, major fire runs, and falling trees. A pilot was killed in a light plane crash, returning to Jackson, WY, from transporting fire personnel on September 12. On September 20, a Bell 206 helicopter crashed while filling a bucket on the Clover-Mist Fire, but the pilot was not seriously injured.

The small number of injuries and shelter deployments probably is largely a result of strategies of indirect perimeter containment and protection of developed areas, limiting exposure of crews to direct attack on fast-moving uncontrollable fire flanks, and the relatively small number of crews on firelines at night.

Crews were overrun or threatened on several fires. On July 14, firefighters deployed shelters as fire burned around the Calfee Creek Patrol cabin on the Clover-Mist Fire. Spike camp #2, on the Fayette Fire, was overrun the night of August 24. Gear was lost and crews spent the night in a safety zone, but no injuries were reported. On August 20, a five-person crew working on the south end of the Storm Creek Fire spent the night in a 30-acre meadow they had burned out as a safety area, as the fire ran south 10 miles up the canyon. There were no injuries, but the Big Park Cabin was lost. On August 25, two firefighters protecting a cabin on the Mink Fire deployed fire shelters in a wet meadow. Four people were forced to escape by working their way through the burning timber, August 26, at a housing subdivision on the Fayette Fire.

On the Huck Fire, 120 people evacuated Bailey Meadows Spike Camp on foot, the night of August 26, leaving gear behind. Crews on the southeast corner of the Hellroaring Fire were forced to move into preplanned safety zones during the intense burning period of August 30. That same day, on the Storm Creek Fire, two crews were cut off by a major fire run through Lost Creek, and spent the night in the rocks near Wolverine Pass. Thirty-nine fire shelters were deployed when Storm Creek Fire overran the Silver Tip Ranch on September 3. They were used primarily as a precautionary move due to the heavy smoke. Three personnel who were positioned in a safe zone during the fire's passage did not deploy shelters. At the same time, Slough Creek Spike Camp was evacuated as the firestorm raged down the drainage. Then on September 7, the Storm Creek Fire Camp was evacuated as a wall of flame ran upcanyon past Cooke City, pushed by winds gusting 40+ miles per hour. On September 9, the Crandall Fire Camp on Clover-Mist was threatened, and was lined and burned-out. Another spike camp on Slough Creek (Hellroaring Fire) was evacuated due to fire danger on September 10. Formal evacuation plans were developed for fire camps, housing areas, and towns threatened by fires.

Safety in grizzly country was also of primary concern. Bear warnings and information were distributed and incorporated into shift plans. Crews saw black bears and grizzly bears, but few problems or encounters were reported. On August 31, National Park Service handled a grizzly threat near Canyon Village Fire Camp. Also, on the North Fork Fire, helicopters were used to head off grizzly bears following crews in Hayden Valley, September 2. On September 10, Beaver Creek Spike Camp on the Hellroaring Fire was evacuated due to grizzly encounters. In September, bears were a concern around Cooke City Fire Camp, with many sightings of black and grizzly bears, and one black bear in camp.

Respiratory problems such as flu, bronchitis, and strep throat became commonplace as crews were exposed to dense smoke, dust, and cold night temperatures.

SECTION 8: MILITARY SUPPORT

WYOMING ARMY NATIONAL GUARD

The State of Wyoming provided support to several fires in the GYA through the Wyoming National Guard and Air National Guard. On August 22, a Wyoming National Guard unit consisting of 31 personnel and 13 vehicles arrived on the Hunter Fire to assist in ground support. On the Fayette Fire several crews and helicopters were used from August 30 until the end of the fire. The Guard's first day on the fireline was September 4. Three Air National Guard 205 helicopters assisted in supplying a number of spike camps. National Guard crews also served on the Corral Creek Fire.

JOINT TASK FORCE YELLOWSTONE

Overview

Due to the depletion of organized fire crews, the Boise Interagency Fire Center (BIFC) requested assistance from the Department of Defense (DoD) to fight wildfires in the Greater Yellowstone Area. By the height of the fire action, personnel from the Army, Marines, Navy, and Air Force were involved. The majority of firefighting strength was drawn from Army units at Fort Lewis, WA, and the 5th Marine Air Ground Task Force from Camp Pendleton, CA.

In response to the BIFC request, two battalions of the motorized 9th ID (MTZ), stationed at Fort Lewis were alerted on August 19 and informed that they would be deployed as firefighters. The following day, an advance party consisting of seven members of the 1st Brigade staff flew to West Yellowstone and met with Federal officials to discuss the use of the two command battalions, the 4-23 Infantry and 1-11 Field Artillery. Personnel from Headquarters, 1st Brigade, 9th ID formed the staff of Task Force RECONDO from August 20 to September 11. Colonel John A. Van Alstyne, Commander of 1st Brigade, 9th ID, commanded the Task Force and performed as the Disaster Control Officer to the Greater Yellowstone Unified Area Command.

By August 23, the 4-23 IN and 1-11 FA had been deployed with an aviation package of 5 CH-47D (Chinook), 2 UH-60 (Blackhawk), and 1 UH-1V (medevac) helicopters. Four additional CH-47D helicopters deployed the next day.

By August 29, it was apparent more help would be needed for wildfire control, so two more battalions were deployed; 2nd Battalion, 2nd Infantry Regiment, and 1st Battalion, 52nd Air Defense Artillery Regiment. Additional aviation assets were brought, for a total of 12 CH-47s, 7 UH-60s, and 1 UH-1V helicopter.

After a meeting with Area Command on September 8, the DoD agreed to commit two more battalions and additional CH-47 and UH-60 helicopter support. September 11, Joint Task Force (JTF) Yellowstone was formed with the staff of Task Force RECONDO as its nucleus. To accommodate the

increased number of personnel, Brigadier General J. B. Taylor assumed command of Joint Task Force Yellowstone and became the Department of Defense Disaster Control Officer on this date. The stated mission was "to provide and sustain forces to conduct firefighting operations in support of the Commander, Greater Yellowstone Unified Area Command." Joint Task Force Yellowstone interacted with civilian firefighting agencies at all command levels.

On September 13, the 1st Battalion, 5th Marine Regiment and the 5th Marine Regimental Headquarters arrived at West Yellowstone. Three days later they were followed by the 3rd Battalion, 5th Marine Regiment.

By September 16, DoD has committed two brigades with a total of six battalions. Military personnel made up 100 crews. On September 17, personnel strength of the Joint Task Force peaked at 4,146 soldiers, marines, sailors, and airmen. There were 4 Army battalions and 2 Marine battalions. By the end of September, the military comprised between 50 and 80 percent of the total firefighting force. In addition to crews, the Department of Defense provided massive air support including helicopters for ferrying firefighters and supplies, fixed wing aircraft equipped for infrared fire detection and mapping, and cargo and troop transports. At its peak, the Joint Task Force's air assets included 18 CH-47s (Chinooks), 12 UH-60s (Blackhawks), 1 UH-1V and 2 UH-60vs (Medevacs), and 2 OV-10s (Mohawks) equipped with infrared.

Air Force elements established an Airlift Control Element (ALCE) at West Yellowstone airport. The ALCE supported JTF Yellowstone by transporting personnel, equipment, and logistical supplies to the Task Force while maintaining a steady mission flow. A 15-person ALCE was also established at the Bozeman Airport to control and supervise the arrival and departure of JTF Yellowstone personnel from that location.

Military firefighters initially prepared for a 7 to 14 day mission. The duration was increased to 21 days to coincide with the rotational patterns of civilian firefighting crews. Final duration was established as a 30-day deployment for the military crews.

The first two battalions were rotated back to Fort Lewis on September 18 and 19, respectively. Elements of Task Force Aviation redeployed to Fort Lewis on September 21. Two Fort Lewis battalions that had been alerted and trained were not deployed, since civilian crews became available to replace rotating crews. The second group of two battalions were scheduled to demobilize on September 25 and 27. Due to cooler temperatures and some rain, the fire situation improved, so both battalions (2-2 Infantry and 1-52 ADA) redeployed on September 25. These units were not replaced on the fire lines.

Also, due to the decrease in fire activity, the use of DoD personnel for rehabilitation work and a lack of civilian fire crews committed, Joint Task Force requested that BIFC release DoD assets and reactivate civilian crews and aircraft. On September 24 all support was released. To allow for the timely transition to civilian firefighting crews, some assets remained

on the fireline after their release date: The 1st Battalion of the 5th Marine Regiment for two extra days; 3rd Battalion of the 5th Marine Regiment for three extra days; and 12 CH-47s for three extra days.

The remaining Army aviation units demobilized on September 27, and on the same day, 1st Battalion of the 5th Marine Regiment redeployed to Camp Pendleton. On the following day, the 3rd Battalion of the 5th Marine Regiment and the Regimental headquarters demobilized. The MAC airflow was rescheduled to airlift the remaining Marines and their heavy equipment back to Camp Pendleton by October 6.

The Department of Defense gained significant benefits from this mission, which included:

- small unit teamwork and cohesiveness
- enhanced individual stamina
- leadership opportunities for first line supervisors
- decentralized execution provided initiative training
- coordination between military and civilian staffs
- "real" mission
- validates EDRE concept and movement training
- team building with sister services
- validates family support systems
- positive public relations for armed services

The costs associated with the firefighting mission were:

- technical proficiency with weapons degraded
- no tactical employment opportunities for company/team level combat operations training.
- disruption to planned and scheduled training programs and supporting resources (ammunition, range priorities, funding)
- personal/family inconvenience due to no-notice nature of the deployment and variable duration of mission.

Operations

The Joint Task Force units received continuous training in firefighting techniques throughout the mission. The initial training of basic firefighting courses was taught at home stations. This eight-hour block of classroom instruction, conducted at company level by 6 (USFS, BLM, NPS) instructors covered the use and safety of hand tools, building firelines, fire conditions and conduct, fire safety, use of the individual fire shelter and burnout procedures.

The training received upon arrival to the fire complexes in The Greater Yellowstone Area was designed to ease military personnel into firefighting. Twenty-person crews were trained in cutting firelines, sharpening tools, safety, use of bladder bags, pumps, hose lays, and chainsaw operations.

During the week of September 5-10, fire crews of military personnel were called on to support suppression efforts in and around the Old Faithful

area, providing these crews needed experience in the use of foam and retardant from fire engines and fire hotline construction.

Each Commander of a Battalion Task Force (BTF) worked closely with the Incident Commander (IC) and his staff. The Incident Commander, in coordination with the Battalion Task Force Commander, provided military assignments, issued firefighting priorities, and ensured resources were provided in order to complete the daily missions. Fire shift plans were distributed to Battery/Company Commanders.

At the Company/Battery level a civilian Strike Team Leader was assigned to provide guidance on the positioning of the fire crews. Each Strike Team was responsible for two 20-person crews.

A civilian Crew Boss was assigned to each crew and was responsible for advising the Officer-in-Charge on all firefighting operations. The experience of the Crew Boss in firefighting was of particular importance for suppression techniques and safety. The camaraderie and sense of belonging was significant; crew bosses were literally "adopted" by the military fire crews.

A total of 1194 hours were flown in direct support of the Yellowstone fires, and they are shown below.

	<u>Hours</u>
Chinooks (CH-47)	745
Blackhawks(UH-60)	433
MEDEVAC	16
	<u>1194</u>

For the entire mission, aircraft of the Joint Task Force Yellowstone Aircraft moved 11,700 personnel and nearly 7,500 tons of cargo, including more than 1 1/2 million gallons of water dropped on fires.

Safety was constantly stressed. The motto was: "Everything involved in this operation is renewable (trees, equipment, vehicles) except soldiers, marines, airmen, sailors and civilian firefighters". The Task Force had only one vehicle accident and no life threatening injuries. Only 16 military personnel had to be evacuated to civilian hospitals; 6 of these were fire-fighting related. Thirteen military fire fighters were transported by Airevac. There were only 11 minor fireline injuries.

SECTION 9: PROTECTION OF LIFE AND PROPERTY

Preplanning and active fire suppression were integral to the success of firefighters in keeping property losses to a minimum. No injuries were sustained by the public or fire crews during intense burnovers of campgrounds, private residential areas and improved areas within and near National Parks and Forests. In the whole GYA, a total of 3 private residences, 13 mobile homes, 10 private cabins, 2 back-country Forest Service cabins, 1 back-country Park Service cabin, 12 Park Service cabins managed by the TW Recreational Services and 6 owned by TW services, 2 dormitory rooms of a Park Service dorm, 6 private outbuildings, 2 Forest Service bridges and miscellaneous fire crew gear were lost or damaged in the fires. Many more structures and improvements were saved by effective fuel reductions, firefighting and protection efforts. For example, in Old Faithful only 20 structures were damaged or destroyed out of the 400 structures in the area.

STORM CREEK/HELLROARING FIRE

Protection

Hellroaring Fire

On August 20, winds were 25 to 30 miles per hour, with gusts to 60 miles per hour on the Hellroaring Fire. The fire was estimated to have sustained a rate of spread of 1 mile per hour for 8 hours. The Bull Moose Forest Service cabin was destroyed and the fire increased in size from 8,000 to 22,000 acres.

On August 31, the fire burned through the area near the Gallatin National Forest Buffalo Fork cabin. The cabin had previously been covered with fire shelters and the surroundings wet with a portable pump. The meadow at the cabin provided an adequate safety zone, and the cabin was not burned.

On September 4, the fire advanced west of Yellowstone National Park's Buffalo Plateau cabin. The cabin was effectively prepared by the Park Service and was saved.

Storm Creek Fire

On July 4 and again on July 20, strong winds caused the Storm Creek Fire to make major advances towards the north threatening to escape the Wilderness. These advances threatened special use recreation residences on the west side of Sioux Charlie Lake, the Beartooth Ranch, Woodbine Campground, Stillwater Mining Company mill and mine, and two recreational residences near Woodbine Campground.

Containment strategy on the north end of the fire was successful. One trail bridge was lost. The Stillwater Trail was closed from the Wounded Man Trail to the trailhead until August 9, when it was considered safe for public travel. The trail was opened on and off for day use to Sioux Charlie Lake during that period.

On August 18, the trail was closed to public use for its entire length in cooperation with the Gallatin NF, which administers the upper Stillwater River Drainage for the Beartooth Ranger District. The Wounded Man Trail was closed at Jordan Pass. A Wilderness Ranger was sent to post the Jordan Pass area and to contact individuals and outfitters in the Lake Plateau Area.

On August 19 and 20, five District personnel were dispatched to set up sprinkler systems on two pack bridges and to evaluate other protection needs to Big Park Cabin. The fire was about 1 1/2 miles from the cabin.

At 2030, August 20th, strong winds associated with a storm front blew the fire 8 to 10 miles to the south, up-canyon, in approximately 4 hours. The fire grew from 5,500 acres to 23,680 acres. The Big Park Cabin and one trail bridge were lost. Five hikers were determined to have been in the drainage when the fire made its run. These individuals protected themselves by getting into the streams and walked out on the 21st. The five-person Forest Service crew protected themselves by establishing a safe zone by burning out a 30-acre meadow and there were no injuries.

By September 4, the Storm Creek Fire had burned over 61,000 acres and 1,176 personnel were assigned to the fire. On this date, the Incident Commander, working with the sheriff's department commenced evacuation of Silver Gate and Cooke City. On September 7, the Incident Command Post and Helibase were evacuated.

Integrated Incident Command, preplanning, and fire suppression tactics kept property losses to a minimum. A synopsis of actions taken to protect life and property in Silver Gate and Cooke City includes:

Incident Objectives of the overhead team direct firefighters to "Provide safety for all personnel...activate contingency (evacuation) plan for Cooke City, Silver Gate, and Incident Command Post".

A "burnout plan" directed "a 2-mile swath between Meridan Peak and Abiathar Peak to protect the communities of Silver Gate and Cooke City.

On September 3, the Incident Commander requests the sheriff to begin precautionary movement of civilians out of Silver Gate and Cooke City. On September 5, the Incident Commander and Sheriff activate a mandatory civilian evacuation plan.

Thirty-nine fire shelters are deployed by crews attempting to protect Silver Tip Ranch. The structure is saved and no injuries occurred.

On September 6, fire makes a major run toward Cooke City and Silver Gate. Structure protection groups begin foaming buildings; crews positioned along dozer lines, begin burn out north of Silver Gate and around homes in the path of the fire. An ember from the

burnout start a spotfire in Silver Gate. Crews cannot stop the fire, which races up the canyon.

On September 8, residents are allowed to return to the towns.

Resources assigned to protect Silver Gate and Cooke City: 12 crew strike teams of 240 people; 7 engine strike teams with 100 personnel; and 12 dozers. Air support was limited due to smoke and wind.

Structure Losses

On September 7, high winds drove the fire through the area of Cooke City, MT. The fire was generally limited to the north side of U.S. 212 (Beartooth Highway) and structure losses occurred in the area generally east of Cooke City and north of the highway. Ten cabins and 7 storage sheds were lost.

FAN FIRE

Protection

On July 24, the Fan Fire became a suppression fire. On July 30, the fire increased 1,900 acres in 6 hours with an additional 2,900 acres burned on August 1. High winds shut down all air support operations. The Sportsman Lake Park Service patrol cabin burned at approximately 2100 on August 1, 1988.

Control of the Fan Fire became the Park's top priority to prevent loss of private lands. Public information and personal contact with local residents became a priority.

Additional resources were ordered with crews staged in seven spike camps due to remote access. Total personnel was 1,529. Handlines, water drops, and burnouts continued, followed by mop up and rehabilitation work begun by military troops on September 3, 1988.

SNAKE RIVER COMPLEX

Protection

On July 21, the Shoshone fire made a wind-driven run, reaching the Continental Divide and threatening Grant Village/West Thumb areas. Grant Village was evacuated on July 23, with fire entering the area on July 26. The Grant Village/West Thumb developments were successfully protected. No structures were lost. A special hazard tree removal crew had been utilized to ensure visitor and employee safety along the South Entrance Road.

The Red Fire started on July 1, with wind-pushed fire forcing the evacuation of Lewis Lake campground and closing the South Entrance Road on July 23. This fire joined the Shoshone Fire on August 8.

The Falls Fire started on July 12, with crews building firelines and backfiring to protect structures on July 21 and 22. This fire joined the Shoshone-Red Fires on August 25.

CLOVER MIST FIRE

Protection

The Clover-Mist Fire first threatened life and property by making a major run near the Calfee Creek Park Service Patrol Cabin. A precautionary fire shelter deployment resulted in no injuries and the cabin was protected. Large acreage in the Lamar River drainage burned during the next two weeks during which five other cabins were protected. Wind-driven fire consumed 13 mobile homes, 3 residences, 6 outbuildings, 1 store, 3 vehicles and 2 boats in the area around Crandall.

A synopsis of actions taken to protect life and property on the Clover Mist Fire includes:

Objectives of the overhead team direct firefighters to "Protect structures in the Crandall area, Cooke City, Silver Gate, and other areas in proximity to the incident."

Action Plans were formulated and distributed for the above named inhabited areas. These plans specifically addressed evacuation procedures, locations of dwellings, and fire suppression tactics to be used in different scenarios dependent on the direction of approach the fire might have taken.

Resources and tactical plans to protect life and property included: 9 crews totalling 203 firefighters, 5 engine companies with a crew of 14, air support in the form of water drops, and fire overhead coordination with local law enforcement, media, and structure fire departments.

Structure Losses

On September 7, 1988, the Clover Mist Fire burned through the area near the Forest Service Crandall Ranger Station on Wyoming Highway 296 (Sunlight Basin Road). All structural loss was within 1 mile of the Clarks Fork South River Bridge on Wyoming Highway 296, Clark County, WY.

Damages and losses at the Painter Estate ranged from 12 to 17 mobile homes lost and 3 damaged. Additional losses were 1 vehicle, 2 aluminum boats, 1 propane tank, a store and 1 residence (36 feet by 48 feet) with an adjacent storage shed. At the Squaw Creek Ranch development, 2 cabins were lost and 1 damaged. At the FJ Bar Ranch, a main residence with an adjacent storage building, a mobile home, an above ground fuel tank and an older model Jeep truck were all a total loss. One half mile south of Painter Estates, a mobile home was lost.

Unexpected strong winds blew the fire into heavily timbered Jones Creek and Northfork of the Shoshone River drainage, burning approximately 40,000 acres in a 12 hour period. Structural fire protection planning, preparation and execution were extraodinarily successful in saving the Pahaska Tepee resort and summer homes, given the fire intensity within the Nothfork and Jones Creek drainages.

MINK FIRE

Protection

The Mink Fire started on July 15 and combined with the Snake Complex on September 1. The Park Service protected the Thorofare Ranger Station and the Hawks Rest Cabin. On 8/25, the helitack crew protecting the State game cabin was threatened by fire and deployed their fire shelters. The cabin was saved and no injuries sustained. Helitack and handcrews successfully protected the Fox Park Forest Service Patrol cabin from 8/31-9/3. The overhead team directed firefighters to "Continue to protect improvements."

HUCK FIRE

Protection

The Huck Fire started on August 20 and made an initial threat on Flagg Ranch, which required evacuation. It spread into Yellowstone Park where it also threatened the Harebell Cabin. Neither structure was lost.

The Buffalo Canyon residential area was also included in a detailed structural protection plan developed by the overhead team in conjunction with local fire officials. The Buffalo Canyon Protection Plan covered:

Turpin Meadows Lodge area and summer homes, Haecker Camp, Mid Canyon Area, Heart 6- Atkinson Motel, Buffalo Valley Estates, Box K Ranch, Evergreen Estates, and Pacific Creek Residential Area.

Resources devoted to life and property protection in Buffalo Canyon included: 8 strike teams of fire engines, 3 hand crews, 4 water tenders, 4 portable pumps, and 1 helicopter

NORTH FORK AND WOLF LAKE FIRES

Protection

The North Fork Fire first threatened structures on July 24, 1988 with a major run toward the Old Faithful area. Protection of life and property became a priority objective for the duration of the North Fork Fire including the following areas:

Old Faithful
Madison Residential Compound
Madison Campground
Norris Campground

West Yellowstone, Montana
Island Park, Idaho
Tower Junction (Administratively managed as the Wolf Lake Fire)
Canyon Village
Slough Creek Campground
Mammoth Hot Springs

Preplanning and active fire suppression were integral to the success of firefighters in keeping property losses to a minimum. No significant, injuries were sustained by the public or fire crews during the intense burnovers of the above named areas. A synopsis of actions taken to protect life and property on the North Fork includes:

"Suppress fire safely...protect life and property...reduce the threat to West Yellowstone..preplan and protect improvements at Old Faithful..maximize control efforts to protect life and property in Island Park and strengthen dozer lines south of West Yellowstone.

Pre-suppression Plan instituted for the Old Faithful Area. This plan provided for:

- Fuel modification around high risk structures
- Powerline protection with insulation and sprinklers
- Fire retardants to pre-treat and direct attack
- Removal of explosives, toxics, and flammables
- Removal of portable high value equipment and property
- Pre-connected large static lines on hydrants
- Identification of hazard areas, high-priority structures, and low-priority structures
- Preselection of supervisors to familiarize them with tactical plan, including field operations

Tactical plans to protect Old Faithful included:

- Large-capacity sprinklers installed
- Burnout operations south of the perimeter of the government area.

Resources assigned to property protection during the burnover period of September 9 included 16 Type I and II engines accompanied by crews of 83, and 3 single-resource crews of 59 firefighters.

Preplanning and active fire suppression tactics were used in the other improved areas threatened periodically by the North Fork Fire:

Backfires were set to reduce fuels in advance of the main fires.

Park roads were periodically closed when visitor safety was threatened.

Norris Campground was evacuated when fire danger became intense.

Fire overhead split the "Wolf Lake" Fire management away from the North Fork Fire to enable better management of each respective incident due to their growing size and complexity.

Bulldozers and handcrews constructed firelines and fuelbreaks to protect the town of West Yellowstone.

West Yellowstone residents were provided information on different stages of the fires through media notices and public meetings provided by Fire Information Officers.

Large capacity sprinklers surrounded the edge of West Yellowstone facing the fire front.

Engine and handcrew strike teams were assigned to provide fire suppression to all developed areas.

Extensive fuel hazard reduction was implemented for Canyon Village.

Structural protection and sprinkler systems saved both Tower Junction, Roosevelt Lodge and Canyon Village. Preparations were in place for structure protection at Lake Village.

Structure Losses

On September 7, the North Fork Fire made a major run at the developed area of Old Faithful. The crown fire, driven by high winds, approached from the south between 1530 and 1600 hours and resulted in the loss or damage to the following properties.

Old Faithful Maintenance Area

A wooden cabin owned by the National Park Service and occupied by a seasonal employee was destroyed.

A dormitory owned by the National Park Service and used by TW Recreational Services, a Park concessionaire, as employee housing sustained damage to two rooms.

Old Faithful Snowlodge Area

The Snowlodge, owned by the National Park Service, and managed by TW Recreational Services, lost a total of 12 cabins and 2 storage buildings.

Old Faithful Employee Cabin Area

Six seasonal employee cabins owned by TW Recreational Services were a total loss. One employee restroom/shower building sustained roof damage. These structures were in generally poor condition due to age and were scheduled for future removal.

Old Faithful Impound/Storage Area

A wooden storage building, jointly owned by the National Park Service and a park concessionaire, Yellowstone Park Service Stations, was destroyed. The contents of the building including a 1973 gas truck and two motorcycles, were destroyed.

Adjacent to the storage facility was an impound yard which contained two vehicles also destroyed by the fire. Ownership of the vehicles has not yet been determined; the concessionaire had applied for title as abandoned property with storage fees due.

HUNTER FIRE

Protection

The Hunter Fire started on August 20. Structure protection had high priority from the onset. The Hunter Barn and Ranch, and numerous homes, were threatened initially with structure protection provided by the engine companies of Grand Teton National Park, and the towns of Moose, Jackson, and eventually Moran, Wy. Structure protection later included the Teton Science School, the Schwiering Studio, and residences near the Shadow Mountain Road, and Ditch Creek. In addition to the above listed structure fire engine companies, dozers provided by the Park Service, Forest Service, and private operators were called in for structure protection. Though the size of the fire quickly grew, all structures escaped fire damage.

FAYETTE FIRE

Protection

The Fayette Fire, which started on August 21, grew rapidly. Suppression efforts were hampered by lack of logistical support due to priorities of other neighboring fires. On August 24, a major fire run overran Spike Camp 2. Government and personal gear was lost, but no personal injuries were reported.

On August 25, major runs continued with threats to a pack station and the resort and subdivision of Boulder Lake. The following steps were taken to protect life and property:

Dozers built fireline outside the wilderness boundary.

Airtankers were used to reduce the spread toward the residences.

Coordination with local structure fire department and citizens produced structure protection and citizen evacuation plans.

Suppression resources for protection of Boulder Lake were: dozers, graders, 2 engine strike teams. 18 hand crews, and a division supervisor assigned specifically to supervise structure protection.

Incident objectives of the overhead team directed firecrews to "Keep the public informed...protect private structures at Boulder Lake Resort."

SECTION 10: FIRE EFFECTS AND ECOLOGY

Natural processes create the diversity of vegetation, wildlife, and landscape patterns that characterizes healthy ecosystems. In the Greater Yellowstone Area, fire is one of the processes that has a major role in shaping the environment. Studies of the 1988 fires will provide an important addition to existing knowledge of fire effects on a variety of vegetation types, wildlife habitats, soils, and water resources.

IMMEDIATE EFFECTS

Forest Service personnel indicate the immediate effects of the Clover-Mist fire to the Shoshone National Forest will be devastating. The fire will create severe and long term impacts to fisheries, watershed, soils, vegetation, wildlife cover and forage, livestock forage and timber products.

A variety of wildlife activity was observed during fires and shortly after fire passed through an area. Two monitors on the Clover-Mist Fire in Yellowstone reported seeing golden eagles and peregrine falcons hovering and flying over smoky meadows along fire perimeters and they frequently observed a family of grouse in a recently burned Engelmann spruce forest. Forest Service employees watched the North Fork Fire burn over a ridgeline one evening and heard elk bugling as if trying to signal or locate each other in the smoky meadow bordering the fire front. Soon they saw the elk wander out of the smoke to stand in the Madison River in an area safe from the advancing fire. Elk and bison have been observed throughout the park in the vicinity of fires and burned areas, seemingly undisturbed by the smoke. Radio-collared bear and elk were documented as returning to an area after fire had passed through.

Within weeks after fire passes, new growth of herbaceous vegetation can occur, and will diversify and become more dense in the following years. Yellowstone National Park biologists have found that by the third growing season after a fire, the forest floor is approximately 70 percent covered by plants including fireweed, lupine, leafy aster, elk sedge, heart-leaved arnica and about 20 other species that were resprouts of species present before the fire. Lupine, fireweed, geranium, and grass sprouts have already been observed on the Mink Fire. Fires typically leave patterns of completely burned areas, more moderately burned areas, and islands of unburned vegetation. The resulting mosaic also reduces the number of fire starts, limits size of subsequent fires, and limits the spread of tree disease.

Another immediate effect of fire is the rapid release of minerals in litter, wood, and rocks that are normally released slowly by microorganisms and weathering. Following a fire, this abundant supply of soluble minerals is available for plant growth. The amount of nutrients that goes into the soil depends on several variables including precipitation amount and intensity, wind, and amount of fuel consumption. Many species of trees, shrubs, forbs, and grasses resprout from root crowns or rhizomes within weeks after a fire, responding both to increased levels of minerals and

light. Precipitation generally accelerates the response. Heat from fire may also be instrumental in hastening the weathering of soil minerals, allowing release of more mineral elements. Preliminary soil sampling on the Snake River Complex Fire in Yellowstone National Park suggests that even with apparently high heating, the soil is generally still a viable reservoir of life for the next growing cycle.

EFFECTS ON VEGETATION

The Greater Yellowstone Area is classified into 9 vegetation categories. Lodgepole pine predominates in Yellowstone National Park, Gallatin National Forest, northern Targhee National Forest, and eastern Beaverhead National Forest. Douglas-fir is most predominant on the Targhee and Caribou National Forests, but also is common in areas of the Gallatin National Forest and northern Yellowstone National Park. The Custer and Shoshone National Forests are characterized by a large portion of subalpine fir-alpine meadow and barren areas, and wheatgrass-needlegrass steppe runs along the eastern edge of Shoshone Forest. The largest concentrations of Engelmann spruce occur in the Bridger-Teton National Forest, along with lodgepole, wheatgrass-needlegrass shrub steppe, and some subalpine fir-alpine area. Grand Teton National Park is primarily subalpine fir-alpine meadow and barren area on the west side and lodgepole and sagebrush steppe on the east side. Scattered islands of aspen and whitebark pine occur throughout the Greater Yellowstone Area. Foothill prairies are very rare, occurring only along the northern edge of the Gallatin and Custer National Forests.

Lodgepole pine is the dominant cover type in the Greater Yellowstone Area. Fire is an important agent in perpetuating and renewing this forest type. (fig. 25) Lodgepole pine is moderately fire tolerant because of its thin bark and pitchy nature, however, the relatively tall and open crown is an asset to fire tolerance. Lodgepole pine produces two types of cones: one that opens at maturity and the other that is a serotinous type that opens after it has been heated by a fire. In many parts of the Rockies, lodgepole pine has predominantly serotinous cones, which ensure a ready seed source for seedling establishment after a fire. In northwestern Wyoming, however, serotiny is not predominant. Most cones open without heat, and the seeds are scattered without fire. Lodgepole pine does have abundant seed production and is a successful invader after fire if there is an adequate seed source nearby.

Without periodic disturbance, the more shade-tolerant spruce and fir understory can replace the lodgepole pine overstory, which does not regenerate successfully on duff in shaded conditions. The typical natural fire history is a few moderately intense burns that thin stands before the ultimate stand-replacing fire.

When lodgepole pine stands are dense and when mortality and downfall contribute to the fuel situation, stand-replacing fires assume a dominant role in the overall succession pattern. Other factors such as infestations of dwarf mistletoe, mountain pine beetle, and spruce budworm as well as effects of preceding fires create tremendous fuel accumulations that

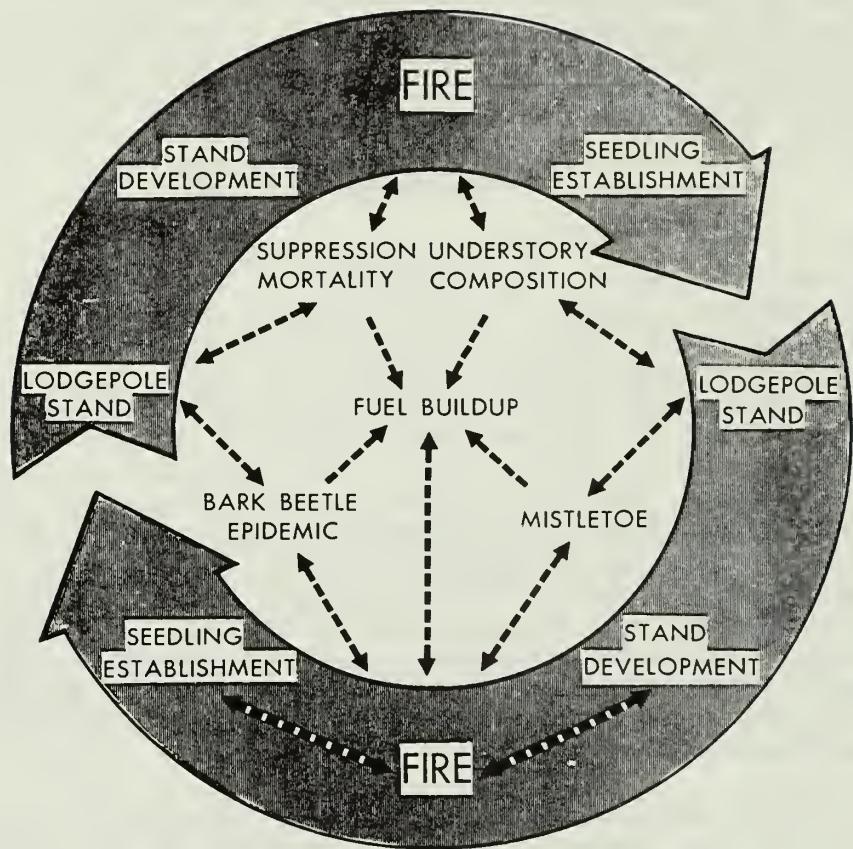


Figure 25. Lodgepole pine fire cycle (from Brown, J.K. 1975. Fire cycles and community dynamics in lodgepole pine forest. Management of lodgepole pine ecosystems. Proceedings. Pullman, WA. Washington State University. 429 - 456.

contribute to violent, widespread burns. The result of such burns is to return the forest to a primary successional stage of early seral species--tree seedlings, shrubs, grasses, and forbs. In Yellowstone National Park, previous stand-replacing fires have mainly occurred in the lodgepole forests that have an understory of spruce and fir. In the extreme conditions of the 1988 fire season, however, all types of lodgepole pine forest burned, regardless of understory type and amount of fuel accumulation.

After lodgepole pine stands attain an age of 80 to 100 years, they become susceptible to attack by mountain pine beetles. The Greater Yellowstone Area has a long history of epidemic populations of these beetles. The most recent infestation started in the 1950's and continued into the 1980's, killing millions of lodgepole pines. The beetle is a natural element of this forest type, and fire has an important ecological role in the cycle of insect infestation. Before the intervention of fire suppression, fires burned throughout this forest type creating a mosaic of age classes, forest structures, and stand sizes that helped contain the spread of infestations. Fire suppression has favored near-monoculture lodgepole stands, inviting widespread epidemics.

The western spruce budworm is a natural element of conifer forests. The spruce budworm has been a persistent defoliator of Douglas-fir, Engelmann spruce, and subalpine fir in the Greater Yellowstone Area. The most recent epidemics of spruce budworm began in the late 1940's and have continued in cycles through the 1980's. Damage to foliage of the host trees ranges from needle loss, to top killing, and to tree mortality in severe situations of repeated heavy defoliation.

Past suppression of fire has led to development of mixed age stands of Douglas-fir at elevations of suitable budworm habitat. The resulting unevenaged, layered tree cover provides an ideal situation for budworm infestation. Past periodic fires created diversity and limited Douglas-fir succession within these forests, by thinning seedlings. As Douglas-fir trees age, they become more tolerant to fire by developing thick bark that insulate them from heat of ground fires. Past fires created savanna-like Douglas-fir stands kept open by periodic ground fires that were frequent enough to thin out small, less tolerant trees. The widely scattered large fire-scarred trees in some of the now dense Douglas-fir stands in the Lamar and Gardiner River Valleys of Yellowstone National Park are probably remnants of these earlier, savanna communities.

Thin bark and low-growing canopy make Engelmann spruce vulnerable to fire damage and to death. Fire recycles spruce stands, which usually revert to lodgepole pine or Douglas-fir at lower elevations. Spruce is not an aggressive early seral species. Initial establishment and early growth of seedlings are slow, but usually good when shade and abundant moisture are available. Restocking will occur more quickly if some spruce trees survive within the burn than if regeneration is dependent on seed from trees at the fire edge. The regeneration is dependent on seed from trees at the fire edge. The regeneration of spruce depends largely on the availability of a seed source.

With a thin bark and a low growing, dense canopy, subalpine fir has little resistance to fire and is readily killed. The vulnerability of subalpine fir to fire is counteracted in the timberline habitat types by the trees growing in small groups separated by rocks and open areas. Low ground fuel loadings on these sites limit fire spread and intensity. In drier and lower elevation habitat types, fir is usually subordinate to the more aggressive early seral species (lodgepole pine and Douglas-fir) and is replaced by these species after fire. In the historical fire sequence, subalpine fir is a minor forest component because thinning and stand fires would occur before it could become a dominate climax species. Like spruce, regeneration of this fir depends primarily on available seed supplies.

In the Rocky Mountains, aspen reproduces almost entirely by sending up vegetative shoots (suckers) from the root system of a clone, and there is apparently very little reproduction by seed. Aspens are readily killed by fire, but large numbers of vegetative sprouts are produced following a fire in an aspen stand (12,000 to 20,000 stems per hectare is not unusual). Hague (1886) noted that in northern Yellowstone Park, aspen is "the first tree to spring up upon recently burned areas" and that "by so doing, it helps to conceal unsightly charred trunks, and adds bright color to the somber hill slopes." A 1971 study in the Jackson Hole area showed that aspen suckering due to stimulation by fire continues for 10 years or more after the fire.

Fire has also acted in the past to prevent the invasion of trees into grassland areas, thus maintaining an equilibrium between forest and grassy meadows and prairies. Periodic fires kill small trees invading grassland areas near forest edges before these trees form clumps that will eventually coalesce into forest.

Fire greatly influences the shrub composition of various community types. Whereas big sagebrush and low sagebrush are killed even by low-intensity fires, many shrub species are stimulated by fires. Willows, silver sagebrush, bitterbrush, rabbitbrush, serviceberry, chokeberry, mountain ash, and snowbrush ceanothus are some of the shrubs of northwestern Wyoming that may resprout after aerial parts are killed by fire. Where sagebrush is killed by fire, grasses and other herbaceous plants flourish following the nutrient release and reduction of competition for soil moisture.

About 39,200 acres burned on the Forest Service lands that are classed as suitable for timber management. These lands represent only about 2.2 percent of all such lands available in the GYA. However, these effects vary greatly by National Forest, and on the Shoshone National Forest these fires will have an impact on the timber management. The following table displays these facts.

<u>National Forest</u>	<u>Suitable Timber Acres in Burn</u>	<u>% Total Forest Suitable Base Acres in Burn</u>
Beaverhead	0	0
Gallatin	3,340	1.2
Custer	0	0
Shoshone	16,000	18.6
Bridger-Teton	0	0
Targhee	11,300	1.6

The 18.6 percent timber base loss on the Shoshone National Forest has occurred on one District and will impact the local lumber mill, which employs 55 people. An analysis of these impacts is underway.

Salvage of fire-damaged timber is one option available to land managers interested in resource recovery. It is used not only to recover marketable timber that is lost in a fire, but can also be used to help mitigate visual impacts, damaged range, wildlife, and fish habitat and reduce the risk of insect infestations or of additional fire. The Forest Service is evaluating salvage potential at this time. The following figures are preliminary and may change as more information becomes available, and as the Forests do future planning and analysis.

<u>National Forest</u>	<u>Total Suitable Volume Lost MMBF</u>	<u>Estimated Volume Considered for Salvage MMBF</u>	<u>Salvage Volume as % of Forest Annual Harvest</u>
Beaverhead	0	0	0
Gallatin	9.5	9	42.5
Custer	0	0	0
Shoshone	100	30	268
Bridger-Teton	0	0	0
Targhee	60	1.5	1.7

On the Shoshone National Forest, potential salvage represents over 2 1/2 times its normal annual harvest. Timber will only be in salvageable condition for about two years before it becomes so cracked and checked that it can no longer provide sawn products. The Gallatin National Forest is considering salvaging an additional 7.5 MMBF (million board feet) from its lands in the Storm Creek Fire near Cooke City. There are also about 1,600 acres of private lands within the burn in this area. These lands also have salvage potential. The Targhee National Forest is the only other area with potential for salvage activities. On the Targhee, only 1.5 MMBF are being considered for salvage, and the local markets are well able to handle this amount.

EFFECTS ON WILDLIFE

Fire effects on wildlife in the GYA have been determined either from habitat requirements or obtained from studies conducted on specific wildfire or prescribed fire areas. Some preliminary observations from the 1988 Greater Yellowstone Area Fires are also included. Detailed studies of effects on wildlife during the fire and during the critical winter months are in progress.

Habitat modification is the major effect of fire on mammals, as opposed to direct mortality. Generally, large animals (deer, elk, black bear, moose, beaver, cougar, coyotes) increase in number after fires as a result of changes in plant succession and increase in nutritive forage. Fire may temporarily displace species dependent on late stages of plant community development (pine marten, wolverine).

Elk and other grazing animals usually avoid intensely burned areas the first year after fires, then increase use of such areas as preferred browse species become available. Moderate fires may remove ground debris and other obstructions to movement. Radio-collared elk have been monitored within burn perimeters for the entire summer on the Red-Shoshone and Clover-Mist Fires. They have shown little movement, wandering primarily between unburned spots. Moose, elk, and bison appear to be inhabiting their normal areas. Fire-initiated early successional stages supporting new growth of grasses, forbs, and shrubs provide a preferred food source for whitetail and mule deer. Fires that result in abundant aspen and willow regeneration create a preferred habitat for moose. For bighorn sheep, removal or opening of the forest canopy can yield increased productivity and palatability of important forage species.

Large numbers of small mammals find adequate food supplies the first growing season following fire. Deer mice are the most abundant small mammals on severely burned areas. Their populations fall immediately following fire, but significantly increase as soon as rain settles the ash. Columbian ground squirrels may increase on areas where the canopy has been opened by fire, especially if grass, forbs, and seed are abundant. Marmot populations are unaffected by fire and benefit from fire-created grassy openings. Mountain cottontails and snowshoe hares are temporarily eliminated from severe burns but reoccupy them as shrub cover increases.

Many carnivores benefit from fire-induced changes. Coyotes, fox, mountain lions, and bears take advantage of small mammal availability in burned areas. Although severe fires may destroy favorable den sites for black bears, both black bears and grizzlies benefit from abundant regeneration of berry-producing plants following fire. Satellite locations on a radio-collared grizzly in Yellowstone showed his movements remain in and around the burn perimeter of the Clover-Mist Fire, which is also the area he foraged last year. Radio-collared mountain lions also show no apparent change in movements as a result of fires.

Literature reports birds generally show no fear of fire and some are attracted to a smoking landscape (insectivores and birds of prey especially). Increased raptor activity has been reported on both the North Fork and Clover-Mist Fires, probably due to less ground cover to protect small mammals. In general, increased sunlight to the forest floor and vigorous vegetation growth may increase bird species diversity in the first years after fire. Ruffed, sharp-tailed and blue grouse and some waterfowl reportedly benefit from fire. Most breeding species of birds stayed after fire in studied areas, only a few species moved out, and a few new species moved in. Raptors and cavity nesters (woodpeckers, mountain bluebirds) likely benefit from the increase in nest trees.

Fisheries will be both negatively and positively impacted by the fires. The detrimental effects will be short-lived and the positive effects long-lasting. The detrimental effects will come from increased siltation in streams, which can affect fish reproduction and stream productivity. The severity of the siltation is determined by precipitation patterns following fires. Normal fall precipitation will cause minimal siltation, but several inches of rain in a short period of time or a sudden spring thaw could cause substantial siltation.

Positive effects of fire come from nutrient transport of forest ashes into the aquatic systems, and increasing organic material from riparian and instream vegetation that occurs after removal of the forest canopy. These changes plus increased water temperatures result in increased aquatic productivity which enhances the fisheries.

Wildlife mortality directly attributed to fire has occurred in the GYA. Unfledged osprey perished in the Red-Shoshone Fire. The Custer National Forest reports that three elk were killed by the Storm Creek Fire when they became trapped in a bluff area near Kersey Lake. The Gardiner Ranger Station on the Gallatin National Forest indicated that two mule deer were killed on the Storm Creek Fire. Fire personnel on the Mink Fire in the Bridger-Teton National Forest reported a moose lying in a creek bottom, apparently injured by the fire. One dead elk was seen in the Jones Creek area and another 21 were found in one bunch in another area of the Clover-Mist Fire on the Shoshone National Forest. Four bison and approximately 180 elk were killed in the Blacktail Plateau area in Yellowstone National Park when the Wolf Lake Fire burned through with a wide fire front and from a combination of suffocation and burns.

The most significant wildlife mortality has been reported by the Shoshone National Forest from the Clover-Mist Fire. A total fish kill was observed along the North Fork of the Shoshone River from Pahaska Lodge north to the Sunlit Peak area. This also included the drainages of Jones, Bear, and Red Creeks. Forest personnel hypothesized that an increase in water temperature and/or change in pH beyond tolerable levels could have been the cause. Forest Service employees on a horse trip into the Clover-Mist burn also found three cow elk, one calf, and two mule deer killed by the fire. They saw a grizzly sow with two cubs and a male black bear feeding on these dead animals and observed numerous other moose, elk, and mule deer feeding in the vicinity of the burn.

There have been a few reports of animal mortality related to fire suppression efforts. More animals have been hit by vehicles this season than in the past, probably due to the increased night travel associated with the fires. Some fish kills were linked to retardant drops: 100 trout died in the Little Firehole River on the North Fork Fire and 150 trout on the Fan Fire in Yellowstone Park.

Yellowstone Park reports some loss of winter range on the North Fork and Hellroaring Fires, and the Shoshone National Forest is in the process of determining winter range loss and they are concerned that hiding cover and thermal cover losses were high on the Clover-Mist Fire. In the event of another below average winter in 1988, the Park expects larger bison movements on the northern winter range compared to last year, and more elk migrating outside of Park boundaries. Above-average snowfall would increase these effects and would result in more winterkill. As of September, 1988, the Park has observed 400 bison west of Tower compared to 80 at this time last year. This early movement of bison may or may not be related to fire effects, as bison are very mobile animals and their mobility is not necessarily a result of food availability.

Yellowstone National Park biologists anticipate that large ungulates, such as bison and elk, will be influenced considerably this year by the drought. Water flow and weather records indicate the summer of 1988 to be far more extreme than the summers of the 1930's drought. Also, these ungulate populations are at higher numerical levels because of the series of mild winters. The Park's ungulates are little bothered or displaced by fire, but the fires of 1988 are also a product of the drought. Thus, the drought has set the stage for several events, including a probable lowering of ungulate numbers.

Animal populations are never static under natural conditions, but rather are expected to show fluctuation in response to changes in the environment. The 1988 fire season is likely one of those times. Wildlife populations have inhabited this area since the Pleistocene ice melted some 10,000 years ago, and have gone through many cycles of weather involving drought, fire, and extremely severe winters.

SECTION 11: AIR QUALITY

Fires in the GYA produced huge quantities of smoke containing particulate matter that posed a significant threat to the health of firefighters, visitors and residents in nearby communities. Numerous firefighters and local residents have experience bronchitis and other respiratory problems and cases continue to be diagnosed. In response to a U.S. Forest Service request and petition from Gardiner residents, the Montana Department of Health and Environmental Science's (MDHES) Air Quality Bureau installed a high volume air sampler (hi-vol) at the Gardiner Ranger Station on August 12, 1988. Pursuant to a request from residents in Cooke City and Yellowstone Park Officials, the MDHES installed a hi-vol in Cooke City and delivered additional equipment to the Park for sites at West Yellowstone and Mammoth. To evaluate health risks for school children, a nephelometer was put in at the Gardiner High School and the National Park Service installed SO_2 and TRS monitors at Mammoth to ascertain levels that might come from burning sulfur in geothermally active areas. A monitor was also installed at the Gardiner High School to measure a carbon monoxide, a product of incomplete combustion from forest fires.

The National Ambient Air Quality Standard for suspended particulates is 150 micrograms per cubic meter (Mg/m^3) for particulate matter with a diameter of 10 microns or less (PM-10). High volume samplers measure the total amount of suspended particulate matter (TSP) of all sizes in the air. The TSP concentrations were converted to PM-10 by multiplying the concentrations by a factor of 0.8. The conversion factor was determined from an EPA study "Emission Factors for Particles from Prescribed Fires by Region in the United States". At Mammoth a PM-10 monitor was installed at the same site as the hi-vol. Hi-vols were used because PM-10s were not available.

Normal operation of particulate monitors is for a 24-hour period, midnight to midnight. However, due to the extremely high readings and a need for quicker dissemination of information to the public, samplers were run for a 12-hour period from 8 a.m. to 8 p.m. and 8 p.m. to 8 a.m. from August 25 to September 12. A balance was taken to Gardiner so filters could be weighed on-site and immediate results reported to the ranger station, the Yellowstone National Park Resource Management Office and the press. All other filters were sent by mail to the MDHES Chemistry Laboratory.

Because of the high concentrations, the Montana emergency episode plan, which is used to prevent ambient concentrations of pollutants from reaching levels that threaten the health, safety and welfare of the community was referenced. The episode prevention action stages are defined as follows:

1. Alert Level - a concentration of pollutants at which first stage control action is to begin: PM-10 - $350 \text{ Mg}/\text{m}^3$, 24-hour average.
2. Warning level - air quality is continuing to degrade and additional control actions are necessary: PM-10 - $420 \text{ Mg}/\text{m}^3$, 24-hour average.

3. Emergency Level - air quality continuing to degrade toward a level of significant harm to human health and most stringent control actions are necessary: PM-10 - 500 Mg/m³, 24-hour average.
4. Levels which cause "significant harm" to the health of persons and should never be reached are: PM-10 - 600 Mg/m³, 24-hour average.

The objective of the emergency episode plan is to control sources within Montana during episode periods of high concentrations of pollutants. At the emergency level a halt or curtailment of all operations, activities, processes or conditions which are reasonably believed to be contributing to the emergency can be ordered. In the case of the Yellowstone fires, control of the source was impossible, so MDHES issued the following advisory:

- Eliminate all unnecessary outdoor activity, stay indoors and limit outdoor ventilation.
- People experiencing respiratory or other health problems from exposure to the smoke should use extreme care to limit exposure, including leaving the area. Persons with chronic respiratory illness or other health problems should consider leaving the area until the air quality situation improves. Persons experiencing health problems should contact local health personnel. Particulate levels for the risk stage and above are shown in table 5 and in figures 26 and 27.

Because Cooke City had to be evacuated several times during the monitoring period due to fire proximity, the TSP readings are incomplete.

The Yellowstone National Park Resource Management Office set up this program with the cooperation of many people. Fire accounts paid for the monitoring, and Park staff from the Northeast Entrance, West Entrance, North District, and the Forest staff from Gardiner collected data. The Air Quality Division, Washington Office, National Park Service, and the State of Montana Air Quality Bureau provided equipment, data analysis, and expertise.

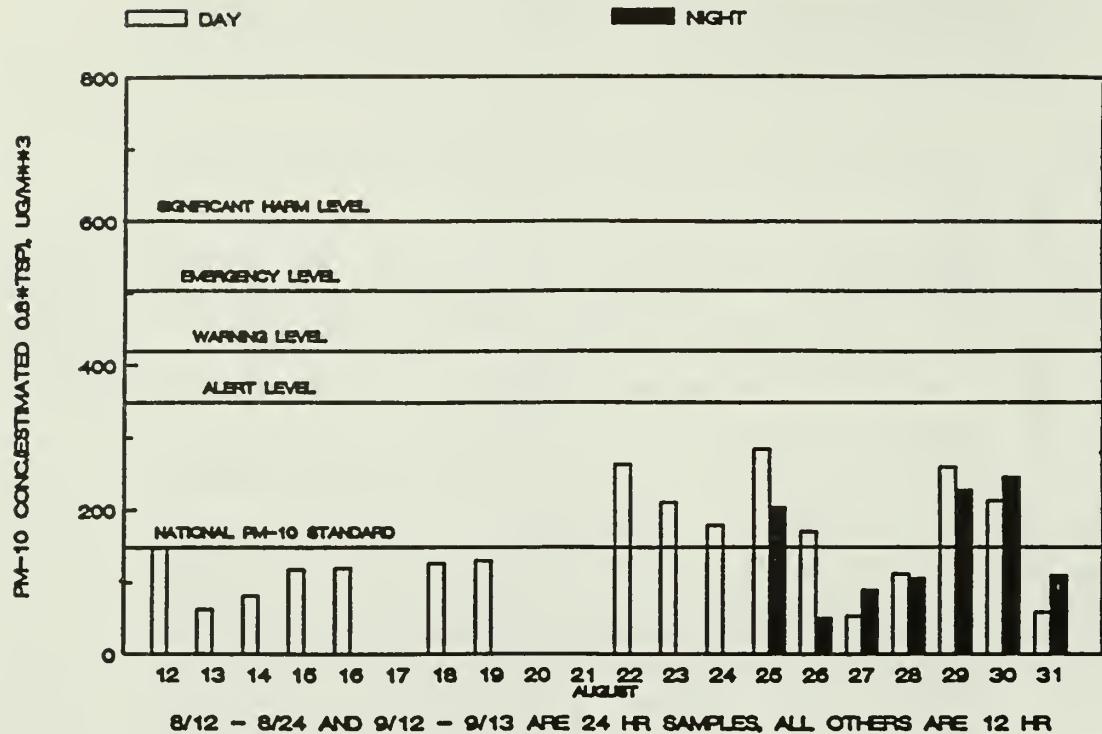
Table 5-Particulate Levels, Yellowstone NP Fires. Distribution of samples exceeding national ambient air quality standard (NAAQS) and emergency episode criteria

LOCATION	Sampling Period	Number of Samples Exceeding--					Significant Harm ² (600) ²
		No. of Samples ¹	NAAQS ₂ (150) ₂	Alert ₂ (350) ₂	Warning ₂ (420) ₂	Emergency ₂ (500) ₂	
Gardiner	8/12-9/29	59	27	7	4	3	3
Montana							
W. Yellowstone	9/01-9/21	33	8	6	6	5	4
Montana							
Mammoth Hot Springs	8/30-9/21	28	13	4	4	3	3
Wyoming							

¹ Sampling Duration varied between 12-hours and 24-hours. Generally samples collected between 8/25 and 9/15 were 12-hour samples, although 12-hour samples (day/night) continue at West Yellowstone. NAAQS and emergency episode levels are based on 24-hour sampling period.

² Micrograms per cubic meter.

PARTICULATE LEVELS, YELLOWSTONE NP FIRES
GARDINER, AUGUST 1988



PARTICULATE LEVELS- YELLOWSTONE NP FIRES
GARDINER, SEPTEMBER 1988

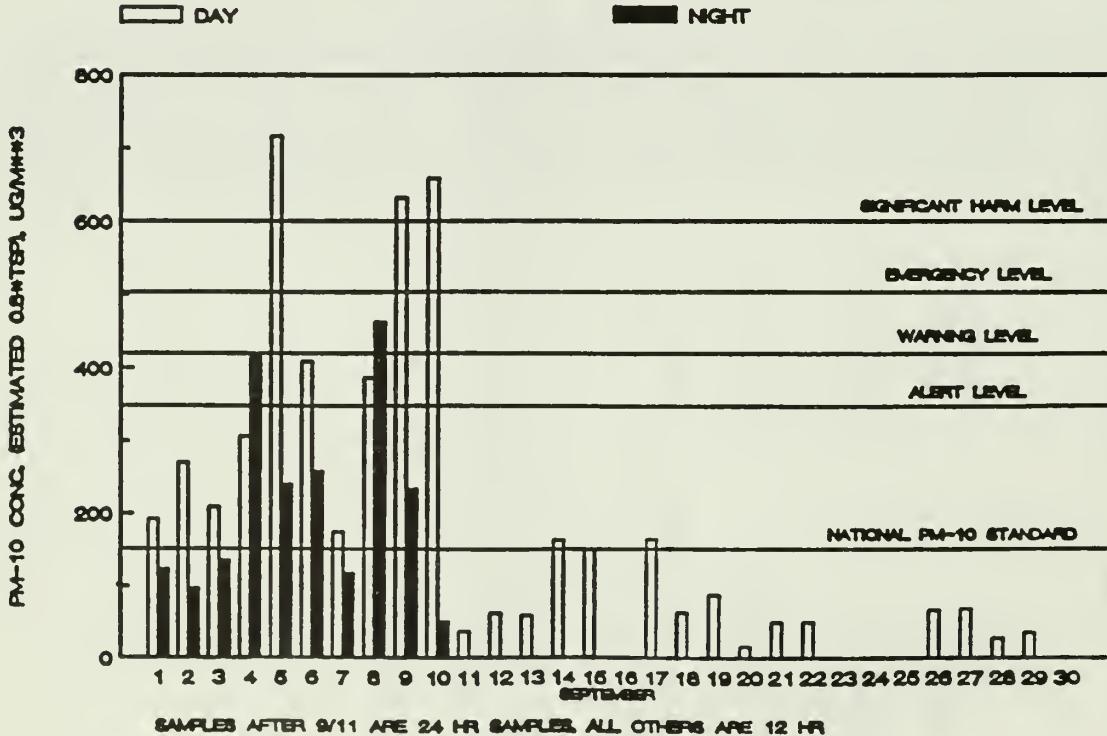
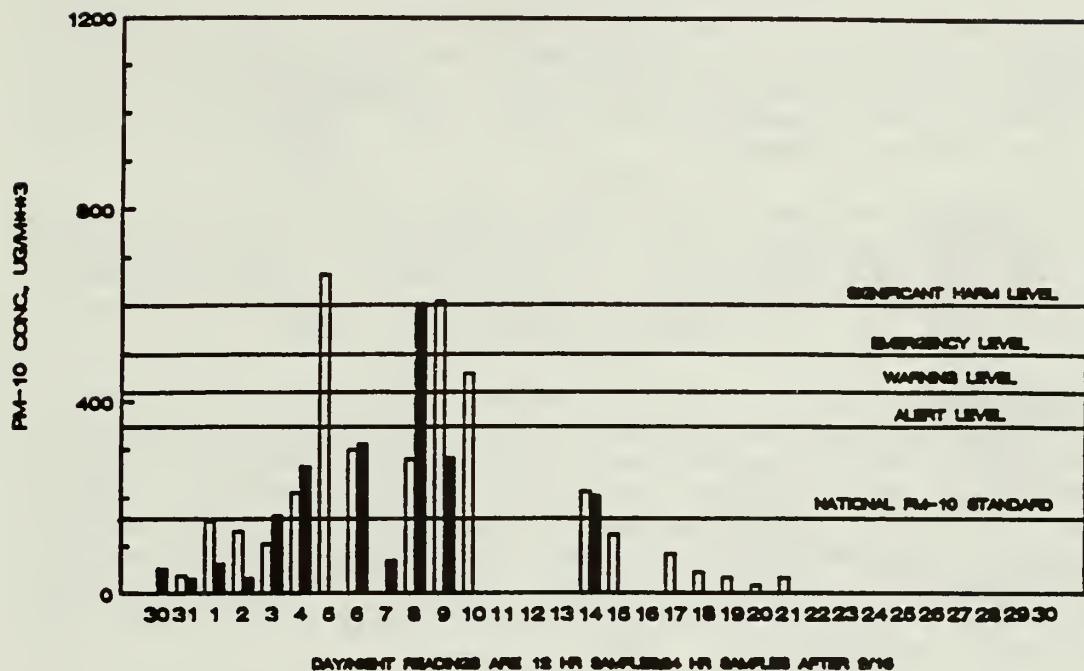


Figure 26. Particulate levels at Gardiner, MT, August and September, 1988.

PARTICULATE LEVELS, YELLOWSTONE NP FIRES
MAMMOTH HOT SPRINGS, AUG-SEPT 1988

■ DAY

■ NIGHT



PARTICULATE LEVELS, YELLOWSTONE NP FIRES
WEST YELLOWSTONE, SEPT 1988

■ DAY

■ NIGHT

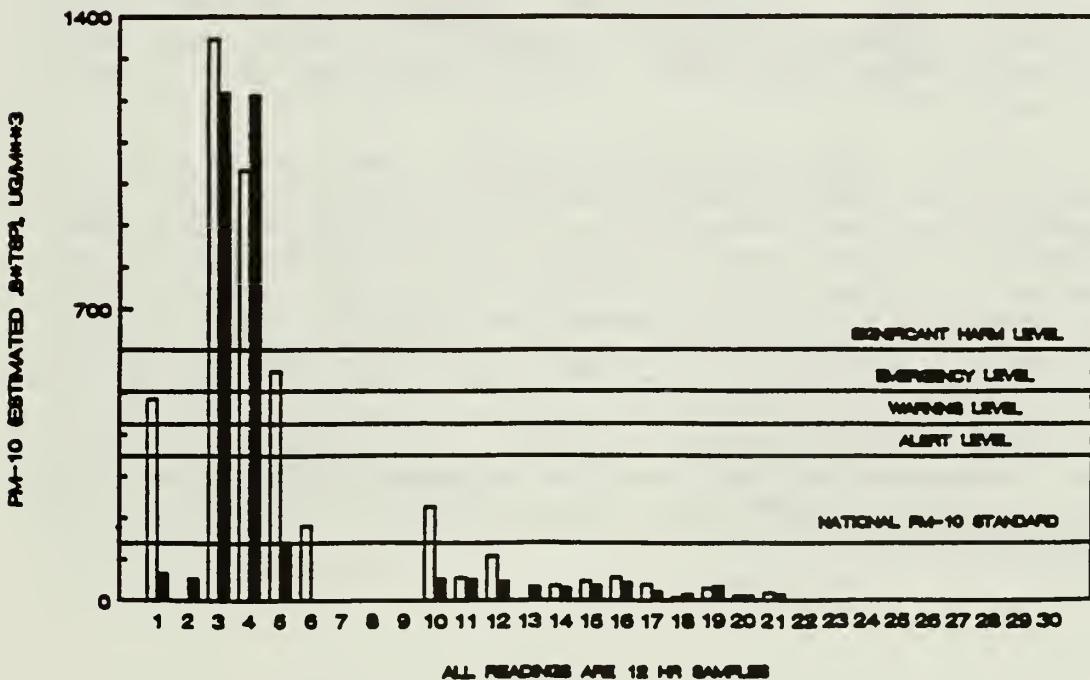


Figure 27. Particulate levels at Mammoth, August-September, and at West Yellowstone, September, 1988.

SECTION 12: PUBLIC INFORMATION

The media and public have shown great interest in the GYA fires at the local, regional, national, and international levels. The distribution of accurate and timely information to the public, elected officials, agency heads, regional offices and the media has been a critical function throughout the duration of the fires.

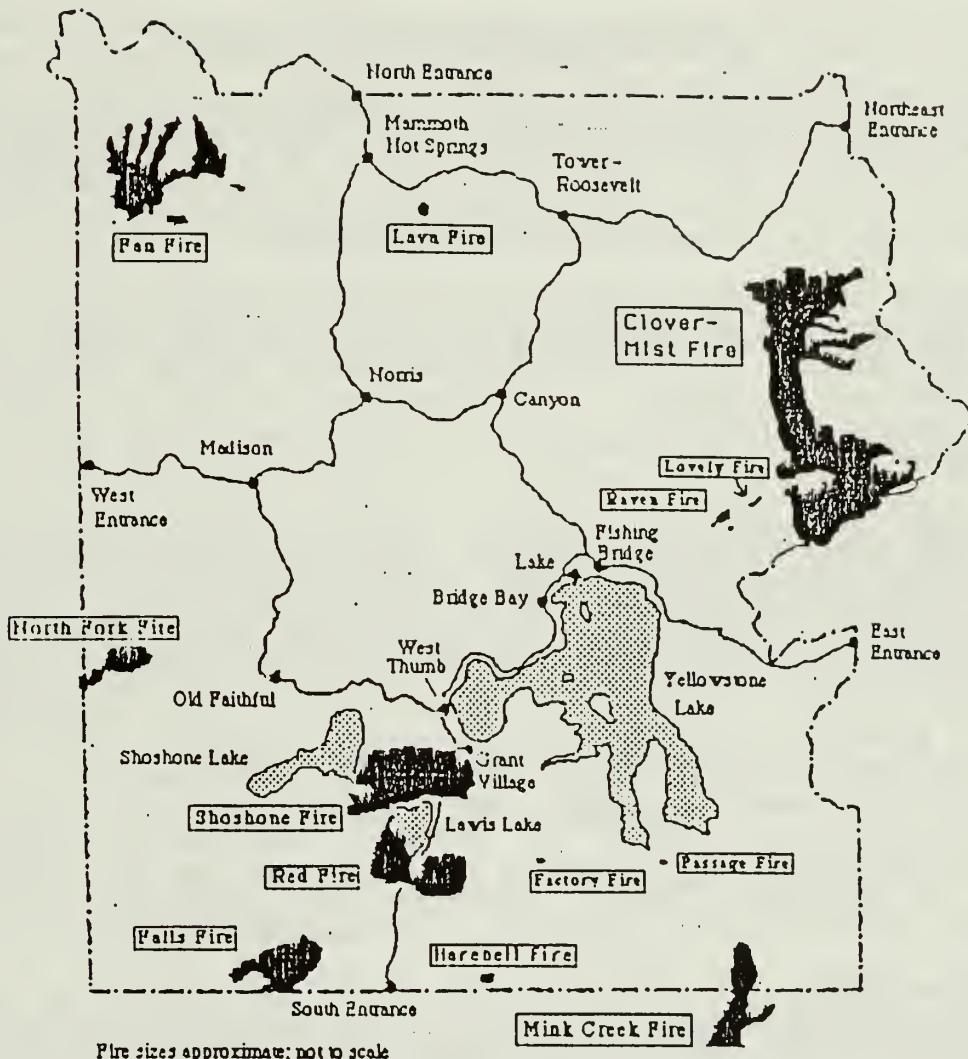
The Yellowstone National Park public information office in Mammoth assumed the role of the central fire information office on June 23, 1988, and this role continued throughout the fire season. Additional public information offices were established at Area Command and public information officers were assigned to each of the incident command teams.

During the early stages of the fire season, most of the media interest was local and regional and was handled by the Yellowstone National Park's two information officers. As the fire season continued and the situation grew increasingly serious, the media and public interest greatly intensified. The public information office eventually grew to a 6 am to 12 pm, seven-day-a-week operation. At the peak of the media interest, staffing at the office grew to 34 persons and was handling over 200 inquiries a day. During the entire summer, the office handled over 2,000 media contacts and over 5,000 public inquiries.

On August 23, a major Area Command public information program was established. This office was assigned to coordinate the gathering of information among the major fires. Information officers assigned to each fire retained the responsibility for developing and implementing public relations programs for their fire. Information specialists conducted community relations programs to reduce public anxiety and provide daily updates of fire activity. Information about the fires was prepared at Area Command in West Yellowstone. Some 67 information officers were located within the Area Command. The Joint Military Command employed 12 public information specialists.

The information program included many forms of communication as well as coordination of media and VIP visits. Particularly effective for Park and Forest visitors, for nearby communities, and for media was the "Daily Fireline Update." Copies were distributed to all businesses in West Yellowstone on a daily basis, thus insuring direct public contact. Copies were also available at a Fire Information Visitors Center in West Yellowstone and at Yellowstone and Grand Teton National Park entrance stations and visitor centers. The "Fireline Update" (fig. 28) was distributed to all Incident Command Posts on all fires and to cooperating agencies. Videos showing extreme fire behavior, fire suppression efforts, interagency involvement, and explaining fire management policies have been distributed to numerous information centers and are available for agency training programs.

Please Post



YELLOWSTONE FIRES

July 25, 1988, at 10:00 a.m.

All but North Fork Fire started from lightning. The sizes of the fires were current as of the date and time above. Many fires are still very active and growing.

Clover-Mist Fire: 31,500 acres. Mist Fire started July 9.

Clover started July 11. Joined on July 22. 71 fire fighters are working to contain at park boundary.

Factory Fire: Small spot. Started July 24. May be spot fire from Red Fire.

Falls Fire: 2,200 acres. Started July 12. Contained on south flank to prevent it leaving the park.

Fan Fire: 3,500 acres. Started June 25. 23 fire fighters are containing this on east side of U.S. 191.

Harebell Fire: 10 acres. Started July 22. 24 fire fighters working on this one.

Lava Fire: 3 acres. Started July 5.

Lovely Fire: 25-35 acres. Started July 20.

Mink Creek Fire: 22,750 acres, including 300 acres in the park. Started July 11.

North Fork Fire: 2,500 acres. Started July 22 by human. Contained on west flank, spreading east.

Passage Fire: less than 1 acre. Started July 18.

Raven Fire: 50-60 acres. Started July 11.

Red Fire: 3,100 acres. Started July 1. Lewis Lake Campground is secure.

Shoshone Fire: 9,000 acres. Started June 23. Threatening Grant Village. 500 fire fighters on the scene for this and Red and Falls fires.

Figure 28. Sample of daily fireline update.

Special efforts were made to inform communities affected by fires. The Incident Commander of the North Fork Fire, which burned near West Yellowstone, briefed the public every other day. Briefings also were broadcast on a local television station. A member of the Area Command staff provided similar briefings on alternate days. When fires burned close to Cooke City, Silver Gate, West Yellowstone, and Gardiner, National Park Service and Forest Service information officers daily held public meetings to explain the fire situation and to respond to questions and concerns.

On the Mink Fire in the Bridger-Teton National Forest, daily information efforts included posting of about 30 bulletin boards, visits to Grand Teton National Park's facilities and visitor centers, updates to dude ranches and outfitter/guides, a daily newspaper for the fire crews, video updates sent to 13 locations, media contacts and occasional horse trips to the fireline.

On the Clover-Mist Fire, Public Information Officers worked with an Information Center at Shoshone National Forest Supervisor's office in Cody to keep both local and National media informed daily of the fire's status. Local residents, tourists, and other concerned groups were also kept informed via four bulletin boards, the Wapiti Visitor Information Center and personal contacts. In addition, media groups were escorted to the fire lines, and a fifth to ninth grade school program on fire suppression was presented at Wapiti. Interagency fire information programs were conducted on the Bridger-Teton National Forest and Grand Teton National Park from mid-July through early September. Daily written and video updates were prepared and express-mailed to Wyoming's congressional delegation, governor's office, visitor's center, agency offices, and the Jackson Hole Chamber of Commerce. Several briefings were held for the public, businesses, concessionaires, homeowners, and employee groups.

Information on air quality was released to the Public by State of Montana news releases, public displays at the Gardiner Post Office, Public Information Officers, National Park Service interpreters, the Yellowstone Superintendent's Office, Area Command in West Yellowstone, and the Fire Information Center in Cooke City. Air quality was also addressed at public meetings when questions arose. Messages to incoming visitors were provided, discussing the hazards of forest fire smoke from a safety and health standpoint.

SECTION 13: POST-FIRE ACTION PROGRAM

In response to the 1988 fire activity in the Greater Yellowstone Area, several initiatives have been identified and are currently in various stages of implementation.

FIRE POLICY REVIEW PANEL

A Fire Policy Review Team will review FS/NPS fire policies for National Parks and Wildernesses. The need for this review is based on observations of the GYA fire situation and concerns expressed by citizens and public officials.

The team will be comprised of individuals who can objectively and professionally evaluate policies and make recommendations, including professionals from the National Park Service, Forest Service, Bureau of Land Management, and a State Forester. The team is expected to consult with experts from the academic community, National Fire Protection Association, and others as may be appropriate, and to provide opportunities for public officials, including the Western Governors Association, interest groups, and citizens to express their views. The Fire Policy Review Team should report by December 15.

FACILITY AND RESOURCE REHABILITATION

National Forest Program

The FS will conduct several programs for rehabilitating fire effects and fire suppression impacts:

One program will restore suppression-related impacts, such as: firelines, fire camps, helispots, litter, etc. Although this program has already been initiated by fire crews on the line, additional work will probably be necessary to complete this effort next spring, following snow melt. This program is supported by fire management funds.

A second program will be emergency rehabilitation of watersheds. Under this program, Congress has authorized funding to protect soil and water resources from unacceptable losses. A variety of projects such as reseeding, water-bar construction, and recontouring of slopes can be authorized under this program following an on-site analysis by an interdisciplinary resource team. Teams have been deployed and all field data has been collected. All reports will be complete by October 1988.

Other fire effects mitigation, including facility replacement and general reforestation, must be paid from regular Forest operating funds. The watershed rehabilitation teams are gathering data to quantify these additional fire effects during their field surveys.

National Park Service Program

The NPS also has several programs underway to address rehabilitation of resources and facilities damaged by the fires. Resource coordinators have been assigned to each of the major fires within the Parks. These individuals have been responsible for documenting any resource impacts that have occurred during the fire suppression efforts. They have prepared fire suppression rehabilitation plans for each of the fires within the Park. These plans delineate firelines, critical Park resources, locations of helispots, locations of slurry drops, fire campsites, and other information considered critical in the rehabilitation effort.

As on National Forest lands, rehabilitation of suppression-related impacts by fire crews has continued during the fire. In addition, Park maintenance crews and fire crews have been rehabilitating areas impacted by fire and suppression activities. Both efforts have been conducted in accordance with the rehabilitation plans. Rehabilitation efforts will continue throughout the fall and will be reinitiated in the spring following snow melt. Types of projects included within the scope of this program include: obliteration of firelines/fire camps/helispots, litter pick-up, erosion control, roadside restoration, snag removal, trail clearing, exotic plant control, and short-term monitoring of resource impacts. These types of rehabilitation projects are supported by fire management funds.

There has also been a significant loss of developed facilities within the Parks. These facilities include: telephone/powerlines, concession guest cabins at Old Faithful, backcountry patrol cabin, picnic areas, signs, etc. The Park is currently preparing a detailed inventory of these losses. No funding is available for replacement of these facilities; supplemental appropriations will be required.

GREATER YELLOWSTONE AREA RESOURCE ASSESSMENT

The Northern Rocky Mountain area has not in recent years experienced a fire of this magnitude. Therefore, careful consideration and analysis is required to accurately predict the full scale of the direct and indirect effects of the fire.

Utilizing aerial photography and resource professionals (hydrologists, wildlife biologists, plant ecologists), the FS and NPS will collect baseline data that documents the full scale of the fire and related suppression efforts on biotic, abiotic and cultural resources in the Greater Yellowstone Area. Summaries of these data will be presented to a panel of experts in the appropriate fields of study. These experts will recommend rehabilitation programs and long term research/monitoring projects that should be undertaken and will interpret the impact of fire.

LONG-TERM RESEARCH AND MONITORING PROGRAM

A long-term research and monitoring program is essential for identifying the effects of a fire of this scope. A research center involving Federal agencies, universities, and others should be considered to facilitate fire research in the Greater Yellowstone Area. Initial direction for this center will be provided by the panel of experts to be formed in the resource assessment effort.

NATIONAL PARK SERVICE FIRE RECOVERY PLAN

The NPS will prepare a comprehensive fire recovery plan for Parks that were significantly impacted by fire during the 1988 fire season. This plan will identify how the NPS will make the Parks immediately available to visitors, the rehabilitation efforts required in the developed and undeveloped portions of the Parks, how the Parks plan to participate with others in the economic recovery of the surrounding communities, how the NPS intends to promote public understanding of the Greater Yellowstone Area fires through an enhanced public information program, the research efforts necessary to fully understand the effects of the large scale fires, and how the NPS intends to encourage and coordinate public participation in accomplishing the recovery of Yellowstone. This information will be summarized in a document that will be broadly distributed for public information.

FOREST SERVICE NATIONAL FIRE SITUATION TEAM

The Forest Service designated a National Fire Recovery Team to provide coordination and leadership for the 1988 western fire situation. It was determined that a coordinated response at the national level outside of normal reporting channels was required. This team will provide assistance to the Forest Service Regions and field as necessary. Major action items will include: fire recovery, fire suppression, economic/community assistance, long-term research, public interest and information, congressional interest and oversight hearing.

GREATER YELLOWSTONE AREA FIRE SUPPRESSION REVIEW PANEL

Normal NPS and FS procedures routinely review major fire suppression efforts. A detailed report summarizing the entire incident from initial fire starts to control is already under preparation. This report will include background information regarding agency fire policy, summaries of Park/forest fire management plans, analysis of weather conditions, suppression strategies, and detailed chronologies of each of the fires. A joint FS/NPS team will conduct a thorough review of how the incidents were handled and identify any operational changes which need to be made to improve future fire suppression efforts.

STATE AND LOCAL COORDINATION

Wyoming Governor Sullivan has appointed a State Coordinator to interface with local, State, and federal programs. The State is ready to provide data in support of agency resource assessments. Governor Sullivan has requested a representative of the Western Governors' Conference be a member of FS-NPS recovery efforts. Montana and Idaho have worked closely with the respective Regions, Forests, and Parks throughout the season, but State coordinators have not been designated.

The previous discussion points out the complexity of the many Federal, State, local, and private efforts underway. Events are moving so quickly that it will be important to continue the coordinated efforts of the Greater Yellowstone Coordinating Committee. Although each agency has separate and distinct missions, and will continue to carry out its project work independently, efficiencies will be recognized through the GYA ecosystem approach.

SECTION 14: CONCLUSION

This report (Phase II) was prepared to provide certain basic documentation of the 1988 fire season in the Greater Yellowstone Area. The GYA includes about 11.7 million acres of Federal land managed jointly by the Forest Service, U.S. Department of Agriculture and National Park Service, U.S. Department of Interior.

The task force assigned to prepare the report had the following objectives:

- Describe fire management policies of the agencies involved.
- Describe fire management plans for each National Forest and National Park comprising the GYA.
- Describe the 1988 fire environment and fire occurrence within the GYA.
- Provide detailed daily chronologies of the 10 major fires in the GYA.

This report is not a fire review, that is an analysis of the management of various fires in the GYA during the 1988 fire season. Rather, it is intended to be a compilation of facts and data to be examined by those who manage National Forests and National Parks.

The information provided in this report was obtained from agency records or through personal interviews. Because of tight deadlines and limited time for review, opportunities for error exist. Nevertheless, the task force believes that within the scope of its assignment, the report accurately depicts the 1988 fire season in the GYA.

APPENDIX A: GLOSSARY

GLOSSARY

Affirms	Administrative and Forest Fire Information Retrieval and Management System. It is a user-oriented, interactive computer program that permits entry of fire weather observations and forecasts, and which performs the computation of fire danger indices, both observed and predicted. Additional information and services are available, including data storage.
Area Command	An organization established to ensure inter-incident coordination for command operations, planning, and logistical matters.
Backfiring	When attack is indirect, intentionally setting fire to fuels inside the control line to slow, knock down, or contain a rapidly spreading fire. Backfiring provides a wide defense perimeter and may be further employed to change the force of the convection column. Backfiring makes possible a strategy of locating control lines at places where the fire can be fought on the firefighter's terms. Except for rare circumstances meeting specified criteria, backfiring is executed on a command decision made through line channels of authority.
Backing Fire	A fire, or that part of a fire, spreading or set to spread against the wind. (See Head Fire).
Blowup	Sudden increase in fire intensity or rate of spread sufficient to prevent direct control or to upset existing control plans. Often accompanied by violent convection, it may also have other characteristics of a fire storm.
Burning Out	Used when attack is direct, or parallel, and the control line touches points of the fire. Burning out is intentionally setting fire to fuels inside the control line to strengthen the line. Burning out is almost always done by the crew boss as a part of line construction. The control line is considered incomplete unless there is no available fuel between the fire and the line.
Camp	A geographical site, within the general incident area, separate from the Incident Base, equipped and staffed to provide sleeping, food, water, and sanitary services to incident personnel.
Cold trailing	A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand to detect any fire, digging out every live spot, and trenching any live edge. No trench is built where the fire edge is dead out.

Confine	To restrict the fire within determined boundaries established either prior to the fire, during the fire, or in an escaped fire situation analysis.
Conflagration	A fire conflagration can best be described as a moving fire storm.
Contain	To surround a fire, and any spot fires therefrom, with control line, as needed, which can reasonably be expected to check the fire's spread under prevailing and predicted conditions.
Control	To complete the control line around a fire, any spot fires therefrom, and any interior islands to be saved; burn out any unburned area adjacent to the fire side of the control line; and cool down all hot spots that are immediate threats to the control line, until the line can reasonably be expected to hold under foreseeable conditions.
Convection Column	The thermally-produced, ascending column of gases, smoke, and debris produced by a fire.
Coyote Crews	Crews camped out three nights at a time near portions of firelines which did not lend to being serviced by a spike camp. These crews would dig line to a certain location each day, and their gear, food and water would be transported ahead of them, generally by helicopter.
Crown Fire	A fire spreading by burning through the crowns of trees.
Direct Attack	A method of suppression that treats the fire as a whole, or all its burning edge, by wetting, cooling, smothering, or by chemically quenching it or mechanically separating it from unburned fuel.
Engine	Any ground vehicle providing specified levels of pumping, water, hose capacity, but with less than the specified level of personnel.
ERC	Energy Release Component (ERC), a measure of the amount of energy that would be released from a single square foot during the time that single square foot was within the flaming front. ERC is weighted towards the larger fuels. Past observations have shown that fires become difficult to contain or control when the ERC value reaches the 80th percentile level.

Escaped Fire	A fire which has exceeded, or is anticipated to exceed, initial action capabilities or the fire management direction or prescription. Fire resulting from a failed fire plan.
EFSA	Escaped Fire Situation Analysis. A decision-making process which produces a document outlining suppression alternatives considered for a fire which has escaped initial attack. It must be reviewed prior to each shift to determine if it is still valid; if not, a revision will be prepared.
Extreme Fire Behavior	Implies a level of wildfire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: High rates-of-spread; prolific crowning and/or spotting; presence of fire whirls; a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment, behaving erratically and sometimes dangerously.
Fine Fuels	Fuels such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly. Also called flash fuels.
Fire Danger	A broad index covering a large area rating the relative flammability of forest fuels.
Fire Management	An extension of the concept of wildfire decision making which takes into account resource values, role of fire in the environment, the level of protection required, opportunities for prescribed use of fire, consideration of fire effects, and the efficiency of the fire control operation.
Fire Storm	A region of fire where exceptionally intense burning occurs. It is usually in an area of heavy fuels, either surface or crown. Exceptionally strong turbulent winds are generated, often from very large firewhirls that cause strong indrafts. The firewhirls can move about within the firestorm area breaking off trees and uprooting them, while at the same time lofting very large firebrands, which are cast into the convection column and carried downwind. The firewhirls can move out of the firestorm area and move downwind producing the characteristic sound of a moving train. As they move down wind they soon lose their fire appearance, but continue as very large vortices, depositing firebrands from their core as they lose strength. They can travel several miles causing blowdown until they lose their strength. The classic firestorm occurred at the confluence of McCormick Creek and the Pack River on the Sundance Fire in Northern Idaho on September 1, 1967.

Firewhirl	A spinning, moving column of ascending air rising from a vortex and carrying aloft smoke, debris and flames. These range from a foot or two in diameter to small tornadoes in size and intensity.
Flame Height	The average height of flames as measured on a vertical axis. It may be less than flame length if flames are angled.
Flame Length	The distance measured from the tip of the flame to the middle of the flaming zone at base of the fire. It is measured on a slant when the flames are tilted due to effects of wind and slope.
Flanking	Attacking a fire by working along the flanks either simultaneously or successively from a less active or anchor point and endeavoring to connect the two lines at the head.
Head Fire	A fire spreading or set to spread with the wind. (See Backing Fire.)
Helitack	Fire suppression using helicopters and trained airborne teams to achieve control of wildfires.
Helitorch	A device attached to a helicopter for the purpose of igniting forest fuels while in flight.
Incident	An occurrence or event, either human-caused or natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.
Incident Action Plan	The incident action plan, which is initially prepared at the first meeting, contains general control objectives reflecting the overall incident strategy, and specific action plans for the next operational period. When complete, the incident action plans will have a number of attachments.
Incident Commander	The individual responsible for the management of all incident operations.
Incident Command Post(ICP)	That location where the primary command functions are based.

Incident Command System(ICS)	The combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure with responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident.
Indirect Attack	A method of suppression in which the control line is mostly located along natural firebreaks, favorable breaks in topography, or at considerable distance from the fire, and all intervening fuel is backbiked or burned out. The strip to be backbiked is wider than in the parallel method and usually allows a choice of the time when burnout or backbiking will be done.
Infrared(IR)	A heat detection system used for fire detection, mapping, and hot spot identification.
Initial Attack	The control efforts taken by resources which are the first to arrive at an incident.
Moisture of Extinction	The upper limit of fuel moisture content beyond which the fire will no longer spread with a uniform front.
NFDRS	National Fire Danger Rating System.
NFFL	Northern Forest Fire Laboratory. (Renamed Intermountain Fire Science Laboratory)
Overhead Personnel	Personnel who are assigned to supervisory positions which include Incident Commander, Command Staff, General Staff, Directors, Supervisors, and Unit Leaders.
Prescribed Fire	A wildland fire burning under specified conditions which will accomplish certain planned objectives. The fire may result from either planned or unplanned ignitions.
Pre-suppression	Describes activities done to reduce hazardous fuels around developed area. These may include prescribed burning, limbing of trees, removal of dead and down woody material, and brush removal.

Probability of Ignition	A rating of the probability that a firebrand (glowing or flaming) will cause a fire, providing it lands on receptive fuels. It is calculated from air temperature, fuel shading, and fuel moisture.
Rate of Spread	The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire; or as rate of forward spread of the fire front; or as rate of increase in area, depending on the intended use of the information. Usually its (forward) rate of spread is expressed in chains or acres per hour.
Relative Humidity	The ratio of the amount of moisture in the air to the amount which the air could hold at the same temperature and pressure if it were saturated; usually expressed in percent.
Running	Behavior of a fire that is spreading rapidly, usually with a well-defined head.
Spot Fire	Fire set outside the perimeter of the main fire by flying (or rolling) sparks or embers.
Spotting	Behavior of a fire producing sparks or embers that are carried by convection columns and/or the wind and which start new fires beyond the zone of direct ignition by the main fire.
Strike Team	Specified combinations of the same kind and type of resources, with common communication and a leader.
Suppression	Management action applied to wildfire, including controlling, containing, and confining.
Torching	Fire burning principally as a surface fire that intermittently ignites the crowns of trees or shrubs as it advances.
Water Tender	Any ground vehicle capable of transporting specified quantities of water.
Wildfire	1. An unwanted wildland fire requiring suppression action, or other action according to Agency policy, as contrasted with a prescribed fire burning within prepared lines enclosing a designated area, under prescribed conditions. 2. A freeburning wildfire unaffected by fire suppression measures.

APPENDIX B: FIRE OCCURENCES

CUSTER NATIONAL FOREST, 1988 FIRE OCCURRENCES

Name	Start	Cause	Fire Type		Status	Situation	
			Prescribed	Wildfire		Date	Acres
Stillwater	01/22	Human		01/22	Out	01/24	20
Lost Lake	06/09	Lightning		06/10	Out	06/11	0.75
Storm Creek	06/14	Lightning	06/20	07/03	Con-tained	09/28	107,847*
Lone Tree	06/23	Lightning		06/23	Out	06/23	0.10
Stevens	07/02	Human		07/02	Out	07/02	0.10
Wildcat Mtn	07/21	Lightning		07/21	Out	07/24	0.50
Horseman Flat	07/23	Lightning		07/23	Out	07/24	0.25
Blases Blaze	07/28	Human		07/30	Out	07/30	0.10
Picket Pin	07/28	Lightning		07/28	Out	07/29	0.25
Rabbit Gulch	08/12	Lightning		08/14	Out	08/16	0.25
Moniak	08/30	Human		09/02	Out	09/03	0.75

* includes acreage in Yellowstone National Park

YELLOWSTONE NATIONAL PARK, 1988 FIRE OCCURRENCES

Name	Start	Cause	Fire Type		Status	Situation	
			Prescribed	Wildfire		Date	Acres
Rose	05/24	Lightning	05/24		Out	05/24	< 1
Observation	06/09	Human		06/09	Out	06/10	< 1
Crystal	06/12	Lightning	06/12		Out	06/12	< 1
Storm Creek	06/14(FS)	Lightning	06/20(FS)	07/03(FS)	Con-tained	09/28	107,847
Cougar	06/23	Lightning	06/23		Out	06/30	< 1
Shoshone	06/23	Lightning	06/23	07/21	****	****	****
Maple	06/25	Lightning	06/25		Out	06/30	< 1
Lewis	06/25	Lightning	06/25		*	*	*
Fan	06/25	Lightning	06/25	07/25	Con-tained	*	23,325
Red	07/01	Lightning	07/01	07/21	****	****	****
Lava	07/05	Lightning	07/05	*	Out	*	*
Miller	07/05	Lightning	07/05		Out	07/25	< 1
Amethyst	07/05	Lightning	07/05		Out	07/12	< 1
Richards	07/07	Lightning	07/07	*	Out	07/31	< 1
Mist	07/09	Lightning	07/09	07/21	***	***	***
Pelican	07/10	Lightning	07/10		Out	07/12	< 1
Cone	07/10	Lightning	07/10		Out	07/12	< 1
Raven	07/11	Lightning	07/11	*	***	***	***
Clover	07/11	Lightning	07/11	07/21	***	***	***
Mink	07/11	Lightning	07/11FS 07/24NPS	07/14	**	**	**

continued

YELLOWSTONE (continued)

Name	Start	Cause	Fire Type		Status	Situation		Acres
			Prescribed	Wildfire		Date		
Falls	07/12	Lightning	07/12	07/17	****	****	****	
Grizzly	07/12	Human		07/12	Out	07/13	< 1	
Narrows	07/14	Human		07/12	Out	07/16	2	
Tower	07/15	Lightning		07/15	Out	07/16	< 1	
Passage	07/17	Lightning	07/17		Out	08/05	< 1	
Spring	07/17	Lightning		07/18	Out	07/18	< 1	
Lovely	07/20	Lightning	07/20	*	***	***	***	
North Fork	07/22	Human		07/22	Con-tained	10/17	400, 100	
Harebell	07/23	Lightning		07/23	Out	07/23	< 1	
Factory	07/24	Lightning	07/24	*	****	****	****	
Hancock	07/28	Lightning		07/28	*	*	*	
Colonnade	07/28	Human		07/28	Out	07/28	< 1	
Continental	07/29	Lightning	07/29	*	****	****	****	
Cub	07/30	Lightning	07/03	*	*	*	35	
South Maple	07/30	Lightning		07/30	Out	08/05	<1	
Shallow	07/31	Lightning	07/31	*	***	***	***	
Basin	07/31	Lightning		07/31	Out	08/02	2	
Terrace	07/31	Lightning	*	*	Out	*	<1	
Badger	08/01	Lightning	08/04	*	****	****	****	
Ridge	08/04	Lightning	08/04	*	****	****	****	

continued

YELLOWSTONE (continued)

Name	Start	Cause	Fire Type		Status	Situation		Acres
			Prescribed	Wildfire		Date		
Fern	08/05	Lightning	08/05	*	***	***	***	
Forest	08/11	Lightning		08/11	Out	08/13	< 1	
Peale	08/11	Lightning		08/11	Out	08/12	1	
Boundary	08/12	Lightning	08/12		Out	08/31	< 1	
Madison	08/13	Lightning	08/13	08/13	*	*	*	
Hellroaring	08/15	Human		08/15(FS) 08/26(NPS)	Con- tained	*	81,950	
Norris	08/16	Human	*	*	Out	*	< 1	
Huck	08/20	Human		08/20	**	**	**	
Wolf Lake	08/25 (07/22)	Human		08/25	*	*	107,460	
Sour	08/27	Lightning	08/27	*	***	***	***	

* no data available

** Huck-Mink Fire, 225,500 Acres, Contained 09/21

*** Clover-Mist Fire, 411,500 Acres, No estimate of containment or control.

**** Snake Complex, 224,000 Acres, Contained-no date

TARGHEE NATIONAL FOREST, 1988 FIRE OCCURRENCE

Name	Start	Cause	<u>Fire Type</u>	Status	<u>Situation</u>	Acres
			Prescribed/Wildfire		Date	
Fence	05/24	Human	05/24	Out	05/24	0.10
Kelly Mtn	05/25	Human	05/25	Out	05/25	3
Cart Hollow	05/26	Lightning	05/26	Out	05/27	1.50
Mike Harris	05/26	Lightning	05/26	Out	05/26	0.10
Burbank Creek	05/28	Human	05/28	Out	05/28	0.10
Pine Creek	06/23	Human	06/23	Out	06/23	0.10
Elkhorn Peak	06/25	Lightning	06/25	Out	06/26	0.10
Walk By	06/25	Lightning	06/25	Out	06/26	0.10
Anderson Mill	06/27	Lightning	06/27	Out	06/27	0.10
Moose Creek	06/30	Human	06/30	Out	06/30	0.10
Teton Canyon	06/30	Human	06/30	Out	06/30	0.10
Reunion Flat	07/02	Human	07/02	Out	07/02	0.10
Chevy	07/02	Human	07/02	Out	07/02	0.10
Little Palisades	07/03	Human	07/03	Out	07/03	0.10
Firecracker	07/03	Human	07/03	Out	07/04	0.10
Cowboy	07/05	Lightning	07/05	Out	07/05	0.25
So.Fk Canyon Creek	07/05	Lightning	07/05	Out	07/05	0.10
Falls Campground	07/10	Human	07/10	Out	07/10	0.10
North Lake	07/11	Lightning	07/11	Out	07/12	0.25

continued

TARGHEE (continued)

Name	Start	Cause	<u>Fire Type</u>	Status	<u>Situation</u>	
			Prescribed/Wildfire		Date	Acres
South Lake	07/11	Lightning	07/11	Out	07/12	0.10
Boone Creek	07/11	Lightning	07/11	Out	07/12	1
Carr	07/11	Powerline	07/11	Out	07/11	0.10
Siddaway Fork	07/09	Human	07/09	Out	07/09	0.25
Upper Palisades	07/10	Human	07/10	Out	07/10	0.10
Chickenspring	07/11	Human	07/11	Out	07/11	0.10
Coffee Pot	07/16	Human	07/16	Out	07/17	0.25
Little Butte	07/19	Human	07/19	Out	07/20	0.25
North Fork	07/22	Human	07/22	Control	11/13	400,000
Highway Sign	07/25	Human	07/25	Out	07/25	0.10
Rock Creek	07/27	Lightning	07/27	Out	07/27	0.10
Break	07/28	Lightning	07/28	Out	07/29	0.50
Steep	07/29	Lightning	07/29	Out	07/29	0.25
Thirsty Creek	07/30	Lightning	07/30	Out	08/02	12
Spring Canyon	07/30	Lightning	07/30	Out	08/11	1,500
Newswander	08/03	Lightning	08/03	Out	08/03	0.10
Falls	08/03	Lightning	08/03	Out	08/03	0.05
Indian Creek	08/08	Lightning	08/08	Out	08/12	0.10
Snake River Bridge	08/09	Human	08/09	Out	08/09	0.10

continued

TARGHEE (continued)

Name	Start	Cause	Fire Type		Situation		
			Prescribed	Wildfire	Status	Date	Acres
Glade Creek	08/11	Lightning		08/11	Out	08/12	0.25
Squirrel	08/11	Lightning		08/11	Out	08/11	0.50
Green Lakes	08/12	Lightning		08/12	Out	08/12	0.10
Cromwell Canyon	08/13	Lightning		08/13	Out	08/13	0.10
Lake Canyon	08/13	Lightning		08/13	Out	08/13	0.10
Flat Canyon	08/15	Human		08/15	Out	08/15	0.10
Crag Canyon	08/18	Lightning		08/18	Out	08/19	5
Palisades Lake	08/18	Lightning		08/18	Out	08/19	3
Williams Creek	08/24	Lightning		08/24	Out	08/24	2
Howard Fire	08/25	Human		08/25	Out	08/25	0.10
Upper Spring	08/26	Human		08/26	Out	08/26	1
No Name	08/27	Human		08/27	Out	08/27	0.10
North Little Butte	08/28	Human		08/28	Out	08/29	1
Thompson Peak	08/30	Lightning		08/30	Out	08/31	0.25
Big Springs	09/03	Human		09/03	Out	09/03	3
Macks	09/05	Human		09/05	Out	09/06	15
Upper Moose	09/05	Powerline		09/10	Out	09/10	0.10
Lucky Dog	09/11	Powerline		09/11	Out	09/11	0.10
Middle Boone	09/15	Human		09/15	Out	09/15	0.10

BRIDGER-TETON NATIONAL FOREST, 1988 FIRE OCCURRENCE

Name	Start	Cause	<u>Fire Type</u>	<u>Situation</u>		
			Prescribed/Wildfire	Status	Date	Acres
Phillips Canyon	05/22	Lightning	05/22	Out	05/26	0.10
Blackened Limb	05/25	Lightning	05/25	Out	05/26	0.10
Cresent 4	05/25	Lightning	05/25	Out	05/27	0.10
Slate Creek	05/26	Lightning	05/26	Out	05/27	1
Truck	06/29	Human	06/29	Out	06/30	2
Pilgrim Creek	07/04	Lightning	07/04	Out	07/10	4
Mink	07/11	Lightning	07/11	07/14	**	**
Road Camp	07/12	Lightning	07/12	Out	07/13	3
Upper Falls	07/12	Lightning	07/12	Out	07/16	10
Curtis Canyon Campground	07/15	Human	07/15	Out	07/16	0.10
Natural Bridge	07/20	Human	07/20	Con-trolled	07/26	1,579
Black Lake	07/21	Lightning	07/21	Out	*	*
Huckleberry Mountain	07/27	Lightning	07/27	Out	07/28	0.75
Sheffield	07/27	Lightning	07/27	Out	07/28	0.10
Red Bud	07/27	Lightning	07/27	Out	*	*
Phillips Pass	07/27	Lightning	07/27	Out	07/28	0.10
Richard's	07/27	Lightning	07/27	Out	07/29	0.10
Curtis	07/28	Human	07/28	Out	07/31	1
Mosquito	07/28	Lightning	07/28	Out	07/31	1

continued

BRIDGER-TETON (continued)

Name	Start	Cause	<u>Fire Type</u>	<u>Situation</u>		
			Prescribed/Wildfire	Status	Date	Acres
Gravel Creek	07/29	Lightning	07/29	Out	07/31	0.25
Lava Mtn	08/02	Lightning	08/02	Out	08/03	0.25
Browns Meadow	08/11	Lightning	08/11	Out	08/13	2
Edwardos	08/13	Lightning	08/13	Out	08/15	1
Upper Sweeney Lake	08/12	Human	08/12	Out	*	*
Sumgling Bridge	08/09	Human	08/09	Out	08/09	0.10
Emerald Lake	08/16	Lightning	08/16	Out	*	1,520
Hancock	08/18	Lightning	08/19	Out	08/20	0.50
Twin	08/18	Lightning	08/18	Out	08/19	0.20
Huck	08/20	Human	08/20	**	**	**
Hunter	08/20	Human	08/20	Out	*	5,440
Fayette	08/21	Lightning	08/21	Con-	09/16	38,507
Rock Creek	08/21	Lightning	08/21	Out	08/25	2
Hart Six	09/05	Human	09/05	Out	09/05	0.10
Two Moose	09/13	Human	09/13	Out	09/13	0.10

* no data available

** Huck-Mink Fire, 225,000 Acres, Contained 09/21

GALLATIN NATIONAL FOREST, 1988 FIRE OCCURRENCE

Name	Start	Cause	Fire Type	Status	Situation	Acres
			Prescribed/Wildfire		Date	
Porcupine	02/28	Human	02/28	Out	02/29	0.10
Phelps Creek	04/11	Human	04/11	Out	04/13	134
Carey	04/26	Human	04/26	Out	04/26	3
Driftwood	05/16	Human	05/16	Out	05/17	0.20
Fridley Creek	06/08	Human	06/08	Out	06/13	5
Yankee Jim	06/10	Human	06/10	Out	06/28	0.10
Moser Creek	06/10	Human	06/10	Out	06/10	0.10
Purdy Creek	06/13	Lightning	06/13	Out	06/14	0.10
Yellows Mule 3	06/17	Lightning	06/17	Out	06/18	0.50
Silver Tip	06/20	Lightning	06/20	Out	06/22	0.30
Smokey	06/22	Lightning	06/22	Out	06/25	3.90
McDonald	06/22	Lightning	06/22	Out	06/24	0.10
Cottonwood	06/26	Lightning	06/26	Out	06/28	0.10
Suction Hose	07/04	Lightning	07/04	Out	07/05	0.10
Slide Rock	07/04	Lightning	07/04	Out	07/05	0.10
Cream Creek	07/04	Lightning	07/04	Out	07/08	0.10
Pine Creek	07/05	Human	07/05	Out	07/05	0.10
Targhee Pass	07/06	Lightning	07/06	Out	07/11	0.10
Tucker	07/07	Lightning	07/07	Out	07/08	0.10
Taylor Fork	07/11	Human	07/11	Out	07/11	0.10
Danskin	07/12	Human	07/12	Out	07/15	0.10
Black Sands	07/13	Human	07/13	Out	07/13	0.10

continued

GALLATIN (continued)

Name	Start	Cause	<u>Fire Type</u>	<u>Situation</u>		
			Prescribed/Wildfire	Status	Date	Acres
Sheep Lake	07/13	Lightning	07/13	Out	07/14	0.10
Dome Mountain	07/15	Lightning	07/15	Out	07/16	0.10
Bald Mountain	07/22	Lightning	07/22	Out	07/27	0.60
Dome Mtn II	07/16	Lightning	07/16	Out	07/18	0.10
Falls Creek	07/18	Lightning	07/18	*	*	0.10
Goose Creek	07/20	Human	07/20	*	*	0.20
Schultz Mtn	07/22	Lightning	07/22	*	*	0.30
Black Sands II	07/22	Human	07/22	*	*	0.10
Bridger	07/23	Human	07/23	*	*	0.20
Lake Kathleen	07/24	Human	07/24	*	*	0.10
Rams Horn	07/25	Lightning	07/25	*	*	0.10
Chimney Rock	08/01	Lightning	08/01	*	*	1
Can	08/04	Human	08/04	*	*	0.10
Karst Fire	08/09	Human	08/09	Out	08/11	0.10
Chestnut Mtn	08/11	Lightning	08/11	*	*	0.20
Black Sands	08/12	Human	08/12	*	*	0.10
Pine Tree	08/13	Lightning	08/13	Out	08/15	0.40
North Derby	08/14	Lightning	08/14	*	*	2
Hellroaring	08/15	Human	08/15	Con- tained	*	81,950
Baboon Mtn	*	Human	*	*	*	0.10
Crow Mtn	08/31	Human	08/31	*	*	0.10

continued

GALLATIN (continued)

Name	Start	Cause	<u>Fire Type</u>	<u>Situation</u>			Acres
			Prescribed/Wildfire	Status	Date		
Dudley Creek	08/31	Human	08/31	Out	09/01	0.10	
Black More	08/22	Human	08/22	Out	08/22	0.10	
Logger Creek	09/03	Squirrel	09/03	*	*	3	
Bems	09/08	Human	09/08	Out	09/08	0.10	
Grayling Arm	09/10	Human	09/10	*	*	8	
Fuel	09/16	Human	09/16	*	*	0.10	
Walma	09/24	Human	09/24	*	*	0.10	
Fevaro	09/25	Human	09/25	*	*	0.10	

* no data available

BEAVERHEAD NATIONAL FOREST, 1988 FIRE OCCURRENCE

Name	Start	Cause	<u>Fire Type</u>	<u>Situation</u>		
			Prescribed/Wildfire	Status	Date	Acres
North Fork Mill Creek	06/25	Lightning	06/25	Out	06/26	0.10
Moonlight Creek	07/04	Lightning	07/04	Out	07/04	0.10
Beartrap	07/04	Lightning	07/05	Out	07/20	85
Goose Creek	07/04	Lightning	07/15	Out	07/16	0.50
Levi	07/21	Human	07/22	Out	08/23	145
Corral Creek	08/29	Human	08/29	Out	09/18	2860

GRAND TETON NATIONAL PARK, 1988 FIRE OCCURRENCE

Name	Start	Cause	Fire Type		Status	Situation		Acres
			Prescribed	Wildfire		Date		
Grand View	05/24	Lightning	05/24		Out	*		0.10
Science School	05/25	Lightning		05/25	Out	*		0.50
Uhl Hill	05/28	Lightning		05/28	Out	*		6
Oxbow	06/17	Human		06/17	Out	*		0.10
RV Stump	07/02	Human		07/02	Out	*		0.10
Talus	07/11	Lightning		07/11	Out	*		0.50
North Bar	07/12	Human		07/12	Out	*		3.70
Perch	07/14	Unknown		07/14	Out	*		0.10
Weiser	07/16	Human		07/16	Out	*		1
Whitegrass	07/24	Unknown		07/24	Out	*		0.10
Power	07/24	Human		07/24	Out	*		0.10
Repeat	07/27	Lightning		07/27	Out	*		0.10
Elk	07/27	Lightning		07/27	Out	*		0.20
Forellen	07/27	Lightning		*	Out	*		0.10
Lake Trail	08/06	Unknown		08/06	Out	*		0.10
Springer	08/09	Human		08/09	Out	*		0.10
Hechtman	08/17	Lightning		08/17	Out	*		0.50
Hunter	08/20	Human		08/20	Con-	09/08		5,440
Huck	08/20	Human		08/20	**	**	**	

* no data available

** Huck-Mink Fire, 225,000 Acres, Contained 09/21

SHOSHONE NATIONAL FOREST, 1988 FIRE OCCURRENCE

Name	Start	Cause	Fire Type		Status	Situation	
			Prescribed	Wildfire		Date	Acres
Beem	04/12	Human		4/12	Out	04/15	8
Black Friday	05/13	Lightning		05/15	Out	05/23	185
Absaroka	05/21	Human		05/21	Out	05/21	0.10
Logan Mtn	05/28	Lightning		05/28	*	*	0.10
Yellow Creek	06/12	Lightning		*	*	*	0.10
Bog Lake	06/13	Lightning		06/13	Out	06/17	1
Wolf Creek #1	06/23	Lightning		06/23	Out	06/24	0.10
Firecracker	06/23	Human		06/23	Con-trolled	06/23	0.10
Chimney Creek	06/23	Lightning	*	*	*	*	0.10
Elk Ridge	06/24	Lightning		06/24	Out	06/25	0.10
Unit 40	06/24	Lightning	*	*	*	*	1650
Rattlesnake	06/28	Lightning		06/28	*	*	0.10
Cut Couley	07/03	Lightning	*	*	*	*	425
Enos Creek	07/10	Lightning		07/10	Out	07/14	0.20
Lovely/ Clover-Mist	07/24	Lightning	*	07/24	**	**	**
Mutt & Jeff	07/26	Human		07/26	Out	07/27	0.10
Galena	07/30	Lightning		07/30	Out	08/03	1.0
Car Mat	08/09	Human		08/09	*	*	0.25

continued

SHOSHONE (continued)

Name	Start	Cause	Fire Type		Status	Situation		Acres
			Prescribed	Wildfire		Date	*	
Crow Peak	08/12	Lightning	*	*	*	*	*	*
Busted	08/13	Lightning		08/13	Out	08/14	0.10	
Ridgetop	08/15	Lightning	*	*	Contained	*	40	

* no data available

** Clover-Mist Fire, 411,500 Acres

APPENDIX C: DETAILED FIRE CHRONOLOGIES

This section provides narrative descriptions of major fires in the GYA. The descriptions provide the following kinds of information: date and source of ignition, location of fire, fire status (prescribed fire, wildlife), threat to structures, status changes and dates of changes, suppression strategies, major fire behavior, significant weather events, IC Teams in charge and dates teams changed.

The information was primarily obtained from Incident Status Summaries (ICS Form 209); Escaped Fire Situation Analysis; fire narratives prepared by the Plans Section, and Daily Shift Plans.

Where documentation was lacking on fire events and major decisions made, information had to be obtained through conversations with the people involved (I.C. Teams, National Park Service and Forest Service personnel). The chronologies retained as much as possible the original wording of the fire narratives written by the individual IC teams.

STORM CREEK

The Storm Creek Fire was started by lightning on the lower part of the Stillwater River drainage within the Lake-Buffalo Plateau Unit of the Absaroka-Beartooth Wilderness. The fire was detected by the Custer National Forest at 1800 on June 19, but an outfitter later reported that he had seen the fire after a lightning storm on June 14.

The Storm Creek Fire joined with the Hellroaring Fire in the Buffalo Plateau area on September 7. The boundary separating the two fires for management purposes is Slough Creek to the south and the Lookout Mountain area to the north. The furthest eastern portion is a finger that extends just beyond the Park County line near Bald Knob. The northern edge of the fire extends up the Stillwater River drainage to the Wildcat Mountain area. The southern boundary is the Wyoming/Montana border, with a dip into Montana toward Abiathar Peak. Elevation ranges from 6,800 to 10,000 feet. The fire was declared contained September 17 at 107,847 acres.

Fire Chronology and Management Actions

After the fire was detected on June 19, the Beartooth Ranger District Office reviewed the Absaroka-Beartooth Wilderness Fire Management Plan and determined the fire met all criteria in the plan to be classified as a prescribed fire. A Wilderness Fire Management Incident Plan was completed, and the District requested prescribed fire status for the Storm Creek Fire at 2300 on June 19 from the Custer National Forest Supervisor. The Supervisor approved prescription status on June 20 at 1000.

The fire was predicted to burn 600 acres under the current foreseeable conditions and 2,200 acres under serious conditions. The two concerns identified in the Wilderness Fire Management Incident Plan were the unusually high ERC for mid-June, special-use residences within the

wilderenss, and smoke in the ventilation shafts of the Stillwater Mining Company in the vicinity of Nye, MT.

From June 20-29, the fire was monitored by air and increased in size to a total of 75 acres. The fire behavior was very predictable during this period. On June 30, the fire moved into heavier fuels and increased 50 acres by July 1.

On July 2, the fire made a major run 3 1/2 miles to the north, bringing the total fire acreage to 2,400. A strong down-canyon wind of 40 miles per hour caused spotting 1/2 to 3/4 mile ahead of the fire front. The fire moved beyond the June 19 predicted northern perimeter. The rocky barrier at Falls Creek, where the fire was predicted to stop to the north, was spotted across, and the fire threatened to cross the northern wilderness boundary. The fire also spotted across to the west side of the Stillwater River.

The fire was pushed to the north by a 20 to 30 mile per hour wind and increased in size by another 600 acres on July 3. It was determined at 1830 that this fire was a potential threat to private property and public safety, and it was declared a wildfire by the Custer National Forest Supervisor.

An Escaped Fire Situation Analysis was prepared on July 4. The strategy alternative selected included partial control of the west side of the fire, protecting the area to the north of Flood Creek and the Cathedral Mountain area. The east side would be allowed to burn as long as it remained within confinement strategy. Pre-attack lines would be established on the north end to protect Woodbine Campground and Beartooth Ranch. This alternative provided for firefighter safety and minimized impact on the wilderness resource, while still providing for public safety and protecting private property.

A Type I Team was ordered at 0800 on July 4, and Ron Curtiss' team arrived at 2145. One IR crew and eight smokejumpers were in place at a spike camp on Flood Creek and were working on two large spot fires on the west side of the Stillwater River. A line officer briefing was held by the District Ranger and his staff. Concerns identified to the Type I Team were protection of life and private property and minimizing smoke problems. The Woodbine Campground and the trail into the Wilderness were closed to the public. The fire was delegated to Ron Curtiss' Type I Team at 2200.

The team moved from Red Lodge to the Woodbine Campground on July 5. This campground became the Incident Command Post (ICP). Crews at the spike camp continued to control and mop up the large spots on the west side of the river. Winds gusting to 30 miles per hour in the afternoon caused some small runs and spotting to the north. The high winds prevented dropping 20 smokejumpers on the fire, so they were bussed to the ICP. The Stillwater Mine gave fire personnel access to its phones, conference room, xerox machine and showers. One helicopter was available. Two more helicopters and two additional crews were to arrive in the evening. Total personnel on the fire was 87, and acreage was at 3,392.

On July 6, 20 smokejumpers were flown to the plateau at the north side of the fire where they cold-trailed, put out spots, and lined where needed to contain the fire. The IR crew and 8 smokejumpers at the spike camp continued to work on the spots on the west side of the river. The two additional crews put in pumps and hose lays at two private cabins and at the Beartooth Ranch. There were higher humidities and scattered showers over the fire, but they were brief and their effects had diminished with the warmer temperatures by early evening. Total personnel was 105.

The Forest Supervisor and the Assistant Fire Staff met with the Incident Commander, Plans Chief, and Fire Behavior Analyst and agreed to continue to contain the fire on the north and west and utilize a confine strategy on the south and east sides where there was currently little movement of the fire. The alternative selected in the original EFSA was reviewed and left in effect.

Winds were more out of the north on July 7, favorable for containing the fire on the north front. Suppression efforts continued on the fire's north edge and on the spot fires to the west. Spot fires to the north were worked with bucket drops and ground attack. mop up of spots and improvement and building of line on the main fire continued July 8. The line was tied into the river and burned out. Plans were made to turn the fire back over to the District by July 10.

One crew, one camp manager, one helicopter, and two probeyes with operators were left on the fire, and the remainder of the crews plus the Type I Team were demobilized on July 10. The fire was officially turned over to the District at 1200 hours. The remaining crew cold-trailed and checked for spots, assisted by bucket drops. The probeyes worked the north and west line as well as the spots.

During the period July 11 to 15 there was no increase in acreage. Resources listed above continued to be utilized, and on the 15th the District put the fire in patrol status. The fire contained hot spots within the burned out area, except for the spot north of Storm Creek on the east side of the river. That spot continued to creep around in the rocks.

During the period July 16-20 there was no change in status. The fire was patrolled by air on an as needed basis. Only visible smoke was on the east side of the Stillwater River up in the rocks north of Storm Creek and the fire appeared to be nearly out. Putting out this smoke was considered at this time but no action was taken as it would require technical rock climbers to reach the fire. It did not appear that the small spot that was burning could spread south of Storm Creek at this time.

On July 21 lightning occurred in the Stillwater Drainage and a new start was discovered 7 miles to the south of the Storm Creek Fire which was suppressed immediately with four smokejumpers. At the same time the Storm Creek Fire became active on the west side of the river. There is a strong possibility that this could have been a new start as there was heavy lightning in the drainage and there had been no visible smoke from the west

side of the river from routine patrols. This increased activity was managed as part of the Storm Creek Fire.

On July 22 the fire became active on the west side of the river south of Flood Creek. Ten District people burned out a line at Cathedral Point, which stopped advance of the fire protecting two special use recreation residences within the wilderness and ensuring that the fire would not escape wilderness boundary. The original EFSA was again reviewed and amended to the 10,000 acreage figure for Alternative B. The fire remained within containment/confinement lines identified in the EFSA. The fire was expected to be confined on the west by rocky barren ridges, on the east by the Stillwater River and Roosevelt Lake, and on the south by one or more rock slides and avalanche chutes. It was considered that the fire could possibly move as far south as the Wounded Man drainage and about one-third of the way up the Flood Creek drainage to the west, resulting in the 10,000 acre figure.

During the period July 23 to August 17 the fire was patrolled on an as-needed basis. A two-person crew worked the containment line on the north end until August 8. The north perimeter continued to stay within the containment/confinement lines. Fire was periodically active on the west side of the river. It continued to creep in the rocky steep slopes in the Flood Creek drainage, with very little movement to the west. On the south side, in this 26-day period, the fire moved approximately 2 miles to the southwest of Roosevelt Lake. The fire moved slowly to the south, west of Roosevelt Lake. The fire moved slowly with minor upslope runs, primarily in the avalanche chutes, where there was an accumulation of fuels. There were no major wind events moving the fire. Winds were generally down canyon (to north), tending to push the fire back into previously burned area. Fire was spotty, with hot areas from the toe of the slope to the ridgeline. Pockets of debris and deep duff held fire in and around the steep rock chutes and slides. Fire crept downslope to the trail or river at widely spaced intervals. During this period of time the fire burned within the confinement strategy on the west, east, and south.

The trail closure was lifted August 9, following flights which showed visible smoke in the upper third of the slope above rocky slide areas. The trail was posted with signs to alert travelers to potential danger of fires in the drainage.

On August 18, the fire began moving into heavier fuels and burned to within 1/2 mile of the Wounded Man drainage. Trail closures were put in place in coordination with the Gallatin National Forest. Three District personnel were dispatched on August 19 to install sprinklers on two bridges in the Wounded Man drainage. Big Park Cabin was evaluated for protection needs. A Wilderness Ranger was dispatched to the Lake Plateau to close trails at Jordan Pass in the head of the Wounded Man drainage and to contact individuals or outfitters known to be in the area. Acreage was at 5,500.

On August 20, two more firefighters were dispatched to assist in bridge protection. Two sprinkler systems were installed on the bridges, and burning out was done around the lower bridge. At 2030, strong winds

associated with a storm front blew the fire approximately 9 miles up-canyon to the south in 4 hours. Wind gusts were estimated at 70 miles per hour. The winds died down to 20 miles per hour at about midnight. The fire increased in size to 23,680 acres. Losses included Big Park cabin and one-track bridge. The five firefighters protecting these resources established a safety zone by burning a 30-acre meadow and were not injured.

A Type II Team and 20 smokejumpers were ordered on August 21. The smokejumper request was denied, but Jim Shell's Type II Team arrived and took over the fire. A new EFSA was prepared, and the objective was to contain the fire in the Stillwater drainage. A lack of crews and equipment impeded progress of fire containment on August 22. Resources included 68 people and 3 helicopters. The fire burned toward Lake Abundance Saddle, and trails were closed in this area.

On August 23, the fire burned into Slough Creek drainage at Lake Abundance and began to burn down Lake Abundance Creek, pushed by strong evening downslope winds. Resources on the fire included 4 helicopters and 166 people. Acreage was at 26,000.

The Storm Creek Fire was turned over to Dave Liebersbach's Type I Team at 1800 on August 24. The fire threatened private property on patented mining claims and also an electronic communications site. Fire suppression efforts continued to be concentrated on containing the fire to the Stillwater drainage, with line building around slop-overs at Lake Abundance. The primary focus of firefighting efforts was to prevent the fire from moving south and threatening Cooke City and Silver Gate. Lines in Daisy Pass and Lulu Pass as well as to the north of Lake Abundance held. A major blowout occurred in the evening as hot dry winds rose out of Stillwater drainage and overflowed down Lake Abundance and Wolverine Creeks.

By August 25, the fire had spread into Wolverine Creek and was burning east toward Slough Creek. Crews pulled back from the Lake Abundance area, and a new containment strategy called for line along the ridge between Wolverine and Lost Creeks. The fire remained 4 miles west of Cooke City. Resources included 10 engines, 4 helicopters, and 321 personnel. Total acreage was 30,000.

An Escaped Fire Situation Analysis was prepared August 25. The strategy was to use the Hellroaring Fire as a fuel break to contain the fire to the southern portion of the Absaroka-Beartooth Wilderness. The priorities were to protect the northern Park boundary and to protect structures in the Boulder River area and at the Silver Tip Ranch.

Predicted northwest winds of 10 to 25 miles per hour on August 26 were expected to increase fire activity in the Wolverine Creek drainage and to cause spotting of up to one mile into Sheep Creek or Miller Creek. Fire spread rates were such that a spot fire in either of these drainages could reach Cooke City in 6 to 8 hours. Evacuation and protection plans were developed for Cooke City, Silver Gate, and Silver Tip Ranch. The sheriff's office initiated a "pre-advisory evacuation notification" which consisted of advising local residents of the possibility that an evacuation could be

called within 12 to 18 hours. The highways into the area and two campgrounds on the Gallatin National Forest were closed.

By 1900, the weather conditions had improved. The extreme winds passed to the east of the fire, and no spotting occurred in Sheep or Miller drainages. The sheriff was advised that the pre-advisory condition could be lifted. At this time, total acreage was 37,500 and resources included 10 engines, 3 bulldozers, 5 helicopters, 4 water tenders, and 668 personnel.

The fire moved very little on August 27, but there was some active burning within the fire perimeter. Retardant drops and helicopter buckets were used to control hot edges of the fire in Wolverine Creek and along Lake Abundance road. Light winds allowed crews to contain the fire east of Wolverine Pass. mop up and burnouts continued in the Goose Creek area. On the western side of the fire, crews completed a fuel break in Wolverine Pass and started construction of containment line down the ridge between Wolverine and Lost Creeks. About half of the line was completed. Coordinated efforts were under way to build a containment line between Hellroaring Fire and Storm Creek Fire. Movement of crews and supplies was repeatedly delayed due to smoke inversions and long distances to fire lines.

On August 29, a burnout was begun on Wolverine Ridge and protection preparation was under way at Silver Tip Ranch and Slough Creek Cabin. Intensive burning occurred August 30 along the northern edge of the fire within the Slough Creek drainage. The fire burned north through Rock Creek to a point roughly parallel with Placer Peaks. Helicopters were used to keep the fire cool along the northern perimeter and in the upper end of the Wolverine drainage. Burnout operations were done to help pull the fire away from the southern containment line. The line was nearly complete between Slough Creek and the rocks on the divide between Wolverine and Lost Creeks. Problems created by steep, inaccessible terrain and poor visibility made it necessary for some crews to hike 12 1/2 miles to line assignments.

On August 31, the containment line between Lost and Wolverine Creeks held until about 2100. A wind shift caused the fire to blow back through the line and into Lost Creek with heavy spotting all along the north side of the creek. Crews stationed on the line could not stop the spots due to the heavy fuels and rapid fire growth. By 2300, the fire was "roaring like a freight train" in the Lost Creek drainage. Two crews cut off from the Slough Creek camp spent the night in rocks near Wolverine Pass. The remainder made it back to camp where they remained camped on a gravel bar. They could hear the fire roaring most of the night. Total acreage was 43,800. Resources included 26 engines, 6 dozers, 7 helicopters, 2 water tenders, and 943 personnel.

Work started the morning of September 1 on the new containment line south of Lost Creek, utilizing the ridge between Wolverine Peak and Cutoff Mountain. The arrival of three batteries of the Army (1-11thFA) allowed additional crews to be deployed on the western lines. Several crews were helicoptered to timbered ridges. Other crews built line from Slough Creek to Bliss Pass, probably the most difficult portion of the line, due to steep

slopes and heavy timber. Meanwhile, a secondary line was constructed along Pebble Creek.

A heavy inversion kept smoke close to the ground and slowed the burning in Lost Creek. Much of the drainage burned, but some fuels remained near the top along Wolverine Ridge. The upper, eastern part of the drainage was successfully backfired to pull heat away from the west and southern edges. Three crews were spiked out near Independence and were beginning the construction of a line across Boulder Creek and on to Pinnacle Peak. This line was intended to stop the northward advance of the Storm Creek and the Hellroaring Fires. The Storm Creek Fire had burned up Slough Creek into the vicinity of Horseshoe Basin.

The inversion layer which slowed down the fire on September 1 lifted on September 2, and intense burning occurred. The fire burned out the remaining fuels in Lost Creek and began a rampage down Slough Creek towards Silver Tip Ranch. It also spilled over the Wolverine ridge and caused spot fires along Pebble Creek. Crews stationed along the creek immediately began to suppress the spot fires. As a consequence, line work along Pebble Creek could not be completed. The fire size was at 50,000 acres.

A fourth EFSA was prepared on September 2. The strategy alternative selected included protection of the Boulder River area, containment of the fire in Pebble Creek, coordination of containment on the south perimeter with the Hellroaring Fire, and containment of the fire to the east of Cooke City. Emphasis was put on public and firefighter safety and protection of structures in Silver Gate, Cooke City, the Boulder River drainage, Slough Creek, and at Silver Tip Ranch.

A new line was started on September 3, utilizing part of Pebble Creek and the Park road through Soda Butte Creek. Intense burning occurred in Slough Creek, and a fire storm was reported. Thirty-nine fire shelters were deployed when fire overran the Silver Tip Ranch and were opened primarily as a precautionary move due to the heavy smoke. Three personnel who were positioned in the safe zone during the fire's passage did not deploy shelters. There were no injuries and no structures were lost. A spike camp at Elk Tongue Creek was evacuated as a fire storm raged down Slough Creek. In the evening, the Incident Commander decided to fall back to the Park Boundary when weather conditions and fire behavior made containment inside the park unfeasible. A pre-evacuation order was issued.

Evacuation of Cooke City and Silver Gate began at 0805 on September 4, and about 65 percent of the local population left. Construction of a six-blade-wide (60 to 70 foot) line was started outside the Northeast entrance of Yellowstone Park. The northeast Park road was closed from Tower Junction to Silver Gate, and Highway 212 was closed except to local residents between Silver Gate and the Sunlight Basin Road junction. One Army battery and 6 crews worked each line. A burnout operation from the dozer line west of Silver Gate started in mid-afternoon to prevent the main fire from running up Soda Butte Creek toward Silver Gate and Cooke City. Vegetation along the line and buildings at the Park Entrance Station were pre-treated with foam. Engine crews were in place for structure

protection. Acreage was at 61,300 and resources included 27 engines, 7 helicopters, 2 water tenders, and 1,176 personnel.

By September 5, the head of Pebble Creek was burned out, and the line was holding at the Park boundary. The main fire expected to burn from Pebble Creek into the burnout by afternoon on September 6. Burnout and mop up continued in an attempt to completely clear at least a two mile buffer down-canyon from Silver Gate. Heavy smoke hampered burnout and made finding spot fires difficult. The dryness of the area caused spots to grow quickly, reaching to over 20 acres in an hour. Total acreage was 65,000.

All went well until about 1830 on September 6, when a spotfire behind the Range Rider in Silver Gate got away and raced up-canyon. The spotfire had been ignited by embers from the burnout operation. Crews and equipment were unsuccessful in catching the blaze, but managed to keep the fire outside the dozer line surrounding Silver Gate. Army batteries manned other parts of burnout line as crews fought spot fires. The fire continued to burn north of Silver Gate through the night. The Governor of Montana banned all non-essential activities outside the limits of incorporated communities (no recreation activities). Marshal law was ordered at 0830 to facilitate evacuation of Silver Gate and Cooke City.

On September 7, high winds hit the fire and accelerated its progress towards Cooke City. The fire spotted over Wolverine Pass and joined the burnout area north of Silver Gate. Back fires were set along Highway 212 and behind Cooke City to direct the fire around town. Winds gusting to 40+ miles per hour caused the fire to race past Cooke City towards Cooke Pass. At 0830, the Storm Creek fire camp was forced to evacuate as the wall of flames ran up-canyon. The Army assisted with the movement to Crandall.

Structure protection crews saved most structures in Silver Gate, Cooke City, and Cooke Pass. Ten residences, 13 storage sheds, and a television transmitter station were lost. The fire burned out the waterline for Silver Gate, but the Army restored service. The fire burned back into the Absaroka-Beartooth Wilderness near Kersey Lake.

By September 8, the fire had grown to 81,000 acres. The Storm Creek and Hellroaring Fires had merged near Buffalo Plateau. Crews and engines were successful in containing fire through Silver Gate, Cooke City, and Cooke Pass. Heavy smoke from the west helped subdue fire. Fire camp prepared to return Friday morning, September 9.

Storm Creek Fire camp was re-established at Cooke Ranger Station on September 9. Heavy smoke and then light rains kept fire activity to a minimum. The intense winds which blew the fire past Cooke City and Cooke Pass subsided as heavy smoke from the Wolf Lake and North Fork fires blanketed the area. The huge convection columns created by those fires blocked the winds which had been predicted. The light rain on September 10 helped to keep down spotting activity and allowed fire crews to get a good start on mopping up the lines around Silver Gate and Cooke City. They did not affect fuel moisture levels or put the fires out.

The fire was still active on several fronts. To the east, it had burned past Kersey Lake, back into the wilderness and was burning in the Russell Creek drainage. To the south, the Clover-Mist Fire had also burned into the area and had burned past Big Moose Lake, several miles south. On the west side of the fire, the combined Hellroaring and Storm Creek Fires continued to move slowly down Slough Creek. On the north side of the fire, the front had moved to within a mile of the pass between the headwaters of Slough Creek and Boulder Creek. A line was completed between Columbine Pass and Independence, but burning conditions were not favorable for a backfire from it.

Snow fell on the fire and base camp September 11. Dampness and lack of winds kept fire subdued. Conditions were not expected to improve for burnout along the northern line for several days so crews were brought back to camp. Acreage was at 93,000 and resources included 26 engines, 5 dozers, 6 helicopters, and 912 personnel.

Weather warmed slightly and the snow stopped by September 12. The fire remained largely inactive with only slight activity in the Bull Creek area on the north side and near Kersey Lake on the south. Mop up proceeded well, 1,000 feet inside the fire perimeter in many areas. Helicopter bucket drops were used on the northern perimeter which had potential of heating up as the weather warmed.

The weather continued to be showery and cool on September 13, allowing more progress on mop up on the south side. It also prevented use of bucket drops on the north side. The IC Team received agreement from both Gallatin and Custer National Forests to allow the fire to burn along the northern perimeter unlined and backfire if burning conditions caused the fire to threaten the current line.

Progress continued on mop up of areas around Cooke City, Silver Gate, and Kersey Lake on September 14-15. Cold line was started to the east of Kersey Lake. Helicopter bucket work continued to cool hot spots in the Bull Creek area.

Net acreage was 107,347 acres. This included lands in Yellowstone National Park and on the Custer, Gallatin, and Shoshone National Forests. Resources included 21 engines, 2 dozers, 4 helicopters, 2 water tenders, and 688 personnel.

On September 16, preparation began for transition of the fire responsibility to a Type II Team. Mop up in the Kersey Lake, Cooke City, Silver Gate, and Cooke Pass continued. Rehabilitation on firelines into Pebble Creek began. Winds gusting to 25+ miles per hour on September 17 increased fire activity in the Broadwater River area and resulted in a 500 acre increase. The fire was declared 100 percent contained at 107,847 acres. Jim Shell's Type II Team took over the fire at 0600 on September 18. The ICP was relocated at the Cooke City Fire Hall. Resources included 21 engines, 4 helicopters, and 678 personnel.

September 19 to October 2, mop up continued on the south side of Soda Butte Creek in the vicinity of structures from Silver Gate to Kersey Lake, inside the Park entrance at the head of Pebble Creek, and in the vicinity of Elk Tongue. No significant moisture was received, but cooler temperatures kept fire activity to a minimum. A containment line was constructed from Slough Creek to a rocky ridge in Elk Tongue Creek to prevent south-ward spread of the fire east of Slough Creek. A spike camp was established at Elk Tongue Cabin to support the effort. Resources included one to four engines, three helicopters, and 178 persons.

October 2, the fire was turned over to the National Forest and the Park Service, and Jim Shell's Type II overhead team was released.

FAN FIRE

The Fan Fire was started by lightning on June 25 in the extreme northwest corner of the park. The origin was located near State Highway 191 and close to the border of Montana and Wyoming where Fan Creek crosses that border. It is situated west of Little Quadrant Mountain and Electric Peak; north of Fawn Trail Pass; east of State Highway 191; and south of the east fork of Speciman Creek. Elevation ranges from 7,200 feet to 9,700 feet. The fire grew to approximately 23,370 acres by the time of control and demobilization on September 6.

Lodgepole pine was the predominant vegetation type which burned in the Fan Fire. The remaining included Engelmann spruce, subalpine fir, Douglas-fir, whitebark pine and non-forested vegetation types. A 1979 fire constituted some of the southern perimeter where the young lodgepole pine aided fire containment.

Fire Chronology and Management Actions

When the fire started on June 25, the Park Fire Committee met to review and evaluate it with regards to the criteria set forth in the Fire Management Plan. Based on the fire behavior, mosaic burn pattern, size, and location, the Committee recommended to the Superintendent and the decision was made to designate it as a prescribed natural fire. This evaluation outlined the course of action to be taken, which included continual monitoring, weather forecasts, public contacts, notification of adjacent landowners and residents, area closures, press releases, smoke considerations, and suppression resource status.

The Fan Fire's growth pattern correlated directly with weather events. In times of hot, dry, windy weather it showed the greatest increase in fire perimeter. For the following six days, fire spread was minimal during mild conditions. Daily monitoring was done primarily on the ground as well as aerial observations to gather onsite weather and burning behavior. Between July 2 and 3, the fire increased from 275 to 1,650 acres. An EFSA prepared by the Park on July 3 placed the fire in confinement mode. This alternative was consistent with the Fire Management Plan, and the fire was expected to stay within the Park under current and predicted fire weather conditions. Strategy was confinement within the Park, daily monitoring, and "light hand

on the land" suppression tactics. On July 5, the fire size was estimated at 1,850 acres, and in the following two-week period, cool, cloudy weather alternated with warm, windy weather. On July 6, Yellowstone Park and Gallatin Forest personnel flew the Fan Fire in rain and scattered snow to plan final suppression efforts.

Ground fire monitors recorded the most active fire behavior during the time period of lowest relative humidity. On July 7 and 8, relative humidity was a low of 13 percent. They observed dependent crowning and torching in LP4 stands on the eastern flank. Rapid spread occurred in short-lasting, upslope headfire runs. Wind and slope were primary factors in the development of dependent crowning and torching of lodgepole and spruce-fir reproduction. Fire spread was predominantly along the southeast flank carried in 1000-hour fuels of downed lodgepole pine. Isolated cases of dependent crown fires generated short range spotting up to one chain ahead of the flank. Ground fire rate of spread averaged 3 to 4.5 chains per hour with flame lengths of 1.5 to 2.5 feet. The fire created a mosaic pattern of burned and unburned areas.

On July 25, Fan Fire was declared a wildfire, and a Type II team was called. The fire was at 3,500 acres. The Mount Hood Area Team (Gary Starkovich, Incident Commander) arrived on July 26 to take command. Incident objectives were to confine the fire within the Park, use "light on the land" suppression tactics, prevent injuries and protect life, and continue monitoring. The suppression mode was advanced to confinement with the goal to keep the fire in the area defined as the Specimen Creek Trail to the junction with the Sportsman Lake Trail, then southeast along the Sportsman Lake Trail to its intersection with the Northfork Fan Creek, then south along the Creek until its junction with the East Fork of Fan Creek, and then southeast along the East Fork. An EFSA prepared on July 27 by Park staff selected more aggressive suppression. Public information was continually prepared.

July 29 summaries show the fire at 5,300 acres. Four crews were on the fire (spike camped) and spotting activity outside the confinement line north of Specimen Creek and southeast of Fan Creek. Fire activity increased on July 30 with an increase of 1,900 acres on the north flank between 1300 and 2000 hours. Helicopter water drops were used to support ground work. Four Type I crews were added on July 31. The eastern perimeters were most active. Activity continued on August 1, with an additional 2,690 acres burned between 1300 and 2100 hours. High winds of 15 to 20 miles per hour with gusts to 40 miles per hour forced the shutdown of all support air operations. Helicopter water drops and retardant drops were used on August 2 in the Sportsman Lake area to stop the fire from burning onto the Gallatin NF and private lands. A strike team of engines and dozers were grouped north of the boundary for use if the fire did cross. Fire size was 15,940 acres.

The Fan Fire became the Park's top priority to control, especially the northeast corner where it had the greatest potential to escape. A Type I Team (Roy Montgomery, Incident Commander) was called and arrived on August 3. The incident objectives remained the same as stated on July 25, with

direction to contain the north, west, and east boundaries and to confine the south boundary. Moderate weather on August 4 allowed crews to mop up with helicopter support. Some line construction was also done on this 16,600 acres fire. Total personnel on the incident was 489, and the fire camp moved from West Yellowstone to Taylor Flat. Higher temperatures, lower humidities, and light to moderate winds increased fire activity on August 5 over the previous few days. In late afternoon, a flareup along the northern perimeter caused by strong winds resulted in a spot fire across Specimen Creek. The area was on a south slope in heavy fuels, which allowed the fire to spread quickly. An additional 1,550 acres burned, bringing the total to 18,150 acres. Public information and personal contact with local residents continued.

In response to the new threat to the northern park boundary, additional resources were ordered. By August 7, 1,024 personnel, 4 helicopters, and 2 air tankers were working on the fire. By August 9, 60 crews were on site engaged in line building, cold trailing, and mop up. Eight helicopters gave support with water drops. Crews were staged in seven spike camps because of remote access. Total personnel was 1,529-the peak day. Cooler temperatures and higher humidities resulted in relatively low fire activity between August 9 and 14, with the exception of some spotting and increased fire activity due to thunder cell winds on August 10. The fire continued to create a mosaic pattern. Suppression work was consequently more effective with emphasis on hot-spotting, mop up, hoselays, patrolling, and rehabilitation. By August 14, 37 crews, 10 overhead, and 1 helicopter were released or reassigned to other fires.

August 14 was the transition to the Type II Team (Steve Raddatz, Incident Commander) from the Type I Team. Confinement boundaries were clarified as the Gallatin Range crest on the east and the 1979 Gallatin Burn on the south. The Park set the standard of receiving the fire when in aerial surveillance. Suppression activities continued as mop up and rehabilitation. Public information and personal contact with local residents continued. Total personnel was 486 people.

August 15 was a day of high fire activity due to low relative humidities and high afternoon winds. Slopovers occurred on divisions that had previously been inactive for several days; perimeter increased 2,170 acres. Crew strength was held at 16 crews, which caused R & R to be delayed a day. Two Division Supervisors and four Type 1 crews were ordered. August 16 was another active day, with higher temperatures and lower relative humidities. Some backfiring was required to hold lines. Area Command met with Gallatin National Forest staff and Ed Francis, Church Universal Triumphant, to discuss fire activity and strategy. Distribution of information to the public continued. Four medical evacuations were necessary for heat exhaustion, dehydration, leg cramps, and strep throat. Since crew conditions were weakening, R & R was planned for 10 crews over the next four days. Some of the resources ordered arrived. Total acreage was 22,540 and personnel was 493.

Direct line construction and water drops were used in following days to keep containment. A storm cell on August 18 caused a 300-acre run in the

southern flank. Gusting winds up to 35 mph on August 19 caused erratic fire behavior. Total area is 22,780 acres with a pattern of burned and unburned areas. Total personnel is 716, 26 crews with 15 on the line, 4 on standby due to travelling all night, and the remainder on R & R. Crew fatigue was an important factor.

August 21 and 22 brought strong northerly winds causing escapes on the southern flanks, but crews and water drops were successful keeping the fire within containment boundaries. Relative humidity continued to be between 8 percent and 12 percent. Although conditions remained hot and dry, but with less wind during the following days, crews were able to keep the fire within the containment boundary. Total size was 23,370 acres. Because of demands elsewhere, crews on the line were decreased to 18, with 2 crews on R & R.

On August 23, crews supported by water drops constructed, burned out and held the line that was lost in two divisions the previous day. Winds were erratic over the fire, and several internal islands flared up. Containment was delayed due to spots appearing adjacent to previously cold-trailed sections of line along the northern perimeter of the fire. There was no change in perimeter acreage. Twenty crews were on the line.

Crews supported by water drops and hose lays continued to mop up Divisions A and Q and worked on individual spots throughout the fire on August 24. Three 50-100 acre flare-ups occurred within the perimeter during the afternoon, and strong winds during the night caused 10-12 spots totalling 5 acres outside the line in Division A near Fawn Pass. Yellowstone National Park advisor Jim Sweeney requested a Type II Team and six crews be available with logistical support when Steve Raddatz was released, approximately August 29.

An inversion on the 25th kept fire activity down until mid-afternoon. The spots outside the line in Division A were lined and most mop up work completed. An aerial reconnaissance showed considerable new smoke on all divisions of the fire except K and L. The decision was made to delay containment indefinitely until these previously cold-trailed sections could be lined, burned out, and mopped up. The recommendation for the transition was to have 10 crews so that 6-8 could be effective each day. Crews on the line were 18, with two on R & R.

At an August 26 meeting of Area Command, fire IC's and Line Officers, strategies and priorities were discussed concerning all GYAC fires. The decision in reference to the Fan Fire was to maintain current resources and hold the fire to its current size. Crews mopped up and held existing lined divisions and spots. Winds changed by mid-afternoon in connection with a cold front. Humidity went up and temperatures down slightly.

The cold front north winds persisted August 27. Fire activity consisted of isolated spots within the confinement boundary. Crews continued to mop up and line as needed. The decision was made to replace existing agency crews with military crews by August 31. Three remaining BIA crews were released, leaving 10 crews on the line. On August 28, briefings

were begun with military liaisons to plan arrivals and logistics. Eight crews worked on mop up supported by five helicopters.

A heavy smoke inversion on August 29 restricted crew and helicopter movement until 1200. Four crews were assigned to the line with two crews on R & R and four crews demobed. Crews continued to mop up hot spots with water drops and hose lays. The 184 military troops plus 11 military officers and 11 agency overhead arrived late afternoon and were set up and outfitted. Containment of the fire was declared at 90 percent.

Mop up continued on August 30, and field training of military troops began. The 340 military troops passing through to the Snake Complex were outfitted. Four agency crews were on the line and two on R & R. The heavy Vertol supported the crews in the morning with water drops and then was loaned to the Snake Complex.

On August 31, the Vertol 234 helicopter was released to the Lolo Fire and two crews released for reassignment. Two crews were on R & R leaving two remaining agency crews assigned to mop up with five military troops. An aerial survey on September 1 prioritized and mapped hot areas for continued mop up. One flare-up near the line in Division E was quickly suppressed but showed potential for escape. The plan for transition to a multi-resource IC, one type II hand crew, and a medium helicopter by September 5 was prepared. On September 2, Area Command verbally approved the transition plan and orders were placed. Fire activity continued to diminish, and the fire was declared 100 percent contained as of 1800 hours.

Effective mop up work by military troops continued September 3-6, with the priority being to mop up and rehabilitate as much as possible. A transition meeting with Area Command was held September 5, and on September 6, the incident was turned over to IC Andy Lang, one Type II crew, one Type 3 helicopter with module, two vehicles, one bus, and supplies. At this date, total cost of the fire was \$8,897,436 and total acreage 23,370.

SNAKE RIVER COMPLEX

The Snake River Complex consists of five separate, lightning-caused fires in the southern part of Yellowstone National Park. The complex burned much of the area bound by the Pitchstone Plateau and Shoshone Lake on the west, Yellowstone Lake on the north, the Yellowstone River on the east and the Snake River and Park boundary on the south. Elevation over the complex ranges from 7,200 to over 10,000 feet. On September 19, when the Snake River Complex was declared 100 percent contained, it covered approximately 224,000 acres and had cost \$9,570,301. Some patrolling and mopping up is still going on, and rehabilitation work to minimize or reduce the impacts of fire suppression activities has just begun. Vegetation over most of the complex is fairly continuous mature to overmature lodgepole, with some spruce/fir understory.

The following narratives trace the history of each fire separately until the fires joined together; by August 24 all the fires had burned together, and thereafter the narrative considers the Complex as a whole.

Fire Chronologies and Management Actions

Shoshone Fire

The Shoshone fire was first observed by the Mt. Sheridan lookout on June 23, on a steep east-facing slope west of the Lewis River, about a mile south of the Shoshone Lake outlet. It was allowed to burn as a Prescribed Natural Fire under the Wildland Fire Management Plan and was kept under observation by the Mt. Sheridan lookout, by helicopter and by monitors on foot.

June 23 to July 11 the fire progressed very slowly, mostly just smoldering and creeping on the ground. On June 26, the fire was mapped at two-thirds of an acre. Estimated acreage remained low: June 30, 2 acres; July 3, 3 acres; July 4, 10 acres; July 5, 28 acres; July 8, 50 acres. On July 9, the fire burned actively with flame lengths of 100 plus feet. Ground monitors were on location staying at the Shoshone Outlet cabin and patrolling daily.

On July 12, the fire jumped to the east side of the Lewis River, reaching 60 acres. This caused concern because the fire was 6 miles in a direct southwest-northeast line from Grant Village. The prescribed natural fire monitors were directed to pay special attention to the spot fire and report any build-up of intensity that could develop into a major run to the northeast.

All through this period, July 13 to July 18, the fire grew slowly, for the most part smoldering and creeping on the ground. There were occasional flare-ups, with trees torching and fire burning more intensely in dense fuels, but no major run occurred. The acreage of the fire again increased slowly: July 14, 72 acres, of which 10 acres were in the spot fire east of the river; July 17, 100 acres; July 18, 108 acres. Monitoring on foot and aerial observation continued daily.

On July 19, the spot fire showed increased activity and on July 20, pushed by high winds, the fire crowned and made its first major run. Spot fires appeared one-quarter to one-half mile ahead of the main front and the fire moved northeast for about 2 miles toward Grant Village before dropping temperatures and high relative humidity slowed it down just south of the Continental Divide at 160 acres. The divide was the line of decision for fire managers. Planning for the protection of Grant Village had been initiated on July 16, and revised since then to include plans for structural protection at Grant Village and West Thumb and contingency plans for the evacuation of those areas.

An EFSA was prepared on July 20, recommending containment to east and north by reducing fuels and burning out along highways, allowing other flanks to burn as Prescribed Natural Fire.

July 21, the Red, Shoshone and Falls fires were put under one command and their status were changed from Prescribed Natural Fire to Wildfire.

Suppression was ordered and the National Park Service requested a Type I Overhead Team.

The fire made a major northeast run toward Grant on July 22, coming to within two miles of Grant Village junction. The South Entrance road was closed for several hours in the afternoon because of down trees in the vicinity of the Continental Divide.

Planners concentrated on mobilizing resources to protect Grant Village. Four crews were promised for Grant on July 23, with the possibility of more being diverted from other fires. The decision was made to evacuate all non-essential personnel from Grant Village and West Thumb by 1100 the next day. At 2150, Park Service representatives left for Grant to review the evacuation plan with concession personnel.

On July 23, Dave Poncin's Type I Overhead Team took over management of the Falls, Red, and Shoshone fires and Grant Village Structural Protection. The incident became known as the Snake River Complex and its first priority was to deflect the fires around developed areas. The Shoshone fire was divided into two divisions: Division A included developed areas of Grant Village and West Thumb; Division B included other fire, with primary consideration being given to the south entrance road. The Snake River Complex command ran both day and night shifts for the next 10 days.

Evacuation of approximately 4,000 people from Grant Village took place on the morning of July 23. It was emphasized that this was a preventative measure to insure the safety of people and property and to enable firefighters to work most effectively and without interference. Following the evacuation of Grant Village, fire camp was moved to the A and B loops of the Grant Village campground, and a helibase was set up at the marina.

During the active burning period after 1300, winds were westerly at 6 miles per hour with gusts to 17, and relative humidity ranged from the low teens to 18 percent. The fire burned actively and advanced a mile eastward across the highway south of the Continental Divide. Size reached 4,500 acres. The road was closed to all non-administrative traffic until July 31.

Personnel on the Snake River Complex on July 23 were 444 at a cost to date of \$175,000 (Shoshone, Red, and Fall Fires).

The assignment on July 24 was for crews in Division A to continue fuels reduction around Grant Village, including removing ladder fuels from around structures, and cutting down and removing snags from roadsides within the developed area. Four hand crews, 20 engines, 1 water tender and 2 bulldozers were utilized. In division B, 4 crews and 1 water tender removed snags and ladder fuels along the south entrance highway.

Helicopters provided bucket drops and airtankers dropped retardant to cool down hot spots and slow the fire's advance. All together, 3 helicopters and 5 retardant bombers were available to the Snake River Complex. The helicopters provided essential logistical support to the firefighting effort.

The fire made no major runs this day, although it did spread to the northeast and approached to within 1/4 mile of the south entrance road due west of Grant Village and base camp. It also burned across about a mile of the highway north of the Riddle Lake trail.

The Shoshone Fire had burned 9,000 acres as of July 24, with 510 personnel committed.

On July 25, the plan for Division A was to complete a hand line west to the main highway and to start fuels modification along the main road near the Grant Village Junction. Five crews, 15 engines, 2 dozers, and 1 water tender were available. A field observer was placed on top of the water tank near the concession dorms to watch for spots in the developed area and report on the progress of the fire. In Division B, 2 crews and a water tender continued fuels modification north along the highway. Air operations were the same as the day before except one helicopter was down for maintenance.

Strong winds caused the fire to be very active this day forming a high convection column with a well developed cumulus cap. During the main burning period from 1500 to 1830 hours, the winds gusted from 6 to 24 miles per hour and were very erratic. Temperatures reached low 80's, and humidity was in low-to-mid teens. The fire burned hot near the Continental Divide and near Lewis Lake with very significant spotting.

Fire Behavior Analysts (FBA's) observed the main fire head as it reached the road near the power line: showers of embers were falling 100 yards in advance of the main fire front with numerous spots occurring 400 to 500 yards in advance. The crews were unable to keep up with spot fires between the road and camp, and by 1700 engines and crews withdrew from the highway to Grant Village.

The easterly advance finally stopped at the road to the campground, leaving all major structures still intact. A large butane tank by the southwest side of the campground caused great anxiety. A portion of "L" loop in the campground was burned and one outhouse was damaged.

July 26, islands of unburned fuels within the Grant Village area continued to torch and burn out. In Grant Village, 8 crews, 15 engines, 2 dozers and 1 water tender mopped up around structures, completed a burnout from camp to the Grant Village junction, mopped up L Loop of the campground and continued fuels modification on the south side of the village. In Division B, 1 crew, 5 engines and 1 water tender were dispatched to secure the West Thumb area. Air operations remained the same, with 1 helicopter still down.

During the evening shift in Division A, 1 crew and 10 engines, patrolled around the buildings of the dormitory and main village areas watching for spot fires. In Division B, 5 engines and 1 water tender patrolled the road and burned the fuel piled by the day shift.

The Shoshone fire became Branch 1 of the Snake River Complex, with Branch 1 divided into 4 divisions around Grant Village and West Thumb.

From July 27 to 29, the fire grew slowly to 10,300 acres. Rain fell from 0900 to 1000, and again in the afternoon on the 27th. Day shifts continued mop up, fuels modification, and snag felling. Successful burnouts were completed around Grant Village and West Thumb. Protection of the Montana Power Substation and powerline were a priority. Night shifts continued mop up and burning of slash piles. Eleven crews, 30 engines, and 3 helicopters worked the fire. For the entire Snake River Complex, a peak of 551 people were committed, with 23,200 acres burned, and a cost to date of \$1,050,000.

Warmer, drier days on July 29 and July 30 combined with moderate southwest to west breezes to push the fire in two major runs on July 30. One head, on the north side of the fire, crossed the highway and moved toward West Thumb; the other head, on the east side of the fire, ran almost due east toward Delusion Lake. Each formed a convection column capped with cumulus development. There was also active spread in the southwest corner of the fire west of the Lewis River. Size is now 11,300 acres. Crews continue to patrol and mop up around the developed areas.

On July 31, continued high temperatures, low humidities, and stronger afternoon breezes out of the west-southwest caused the fire to burn hot. The South Entrance Highway was reopened to public at 0900. A fifth division was added to Branch 1, encompassing the powerline from West Thumb north to Fishing Bridge, and one crew began felling snags along the powerline. Other crews continued mop up and structure protection. Size was 12,000 acres.

August 1, southwest winds with gusts to 30 miles per hour pushed a narrow run east from Delusion Lake to Eagle Bay on Yellowstone Lake, increasing acreage to 16,100 acres. Work concentrated on fuels modification along the powerline, while much reduced forces continued mop up in developed areas.

On August 2 and 3, crews continued to protect the powerline, cutting and removing fuels, wrapping power poles with fire shelters to 12-foot heights, and installing sprinker systems. Torching and spotting remaining problems along the powerline, in part, because of erratic winds within the powerline corridor. Despite major efforts to protect the powerline, about 22 poles were lost and the line was out of service for approximately three weeks. Two portable generators, one 500KW and one 650KW, were brought in to supply power to Grant Village during that period. Night crews continued patrol and mop up.

The Type I team declared 100 percent containment for the protection of Grant Village and West Thumb on August 2 at 2000 hours. The Shoshone Fire (Branch 1) was reduced to 2 divisions on August 3, and at 2000, Dave Fisher's Type II Team took over the Snake River Complex. In discussing the transition, Dave Poncin identified the northeast corner of the Shoshone fire and the power line corridor as the most immediate threats. He also observed that meadow grasses, which had served as a barrier to fire spread had cured

in the time the Type I team had been at the Snake River Complex, and now would spread fire quickly under windy conditions. Shoshone Fire was now 18,000 acres.

From August 4 to 9, the fire spread steadily although there were no major runs. The peninsula east of West Thumb continued to burn out and the fire heading north and east of Duck Lake kept torching and creeping through heavy fuels. Crews built line between West Thumb and the Old Faithful Highway, and saw teams continued felling snags in the powerline corridor. The Shoshone fire burned together with the Red fire around August 8 in the area south of Riddle Lake, for a combined size estimated at 48,662 acres on August 9.

Red-Shoshone Fire

On August 10, management of the Snake River Complex was transferred to another Type II team headed by Tim Sexton. Top priorities were to use tactics that were effective yet light on the land, to protect to the power line, and to keep fire from the developed areas of Grant Village and West Thumb. Grant Village reopened to the public on August 12 and Lewis Lake Campground reopened the next day.

From August 10 through 19, the fire tested the line along the northwest flank near Duck Lake. Crews continued intensive mop up, using hoselays and bladder bags. On August 16 a helicopter with a bucket flew air support to cool down hotspots in that area. The South Entrance road from Grant Village to Lewis Falls was patrolled constantly. Planners were concerned about a fire just north of Lewis Lake that was burning actively and had the potential to move east and threaten the road again. A spot north of Summit Creek threatened the Outlet Cabin and required attention. Overall the work force on the Red/Shoshone fire during this time consisted of 3 crews, 1 saw team, 5 engines, a water tender and 3 helicopters.

On August 19, the fire made a run up Beaver Creek, near Heart Lake, with temperature in mid 70's, humidity low teens, and winds gusting to about 20 miles per hour. It moved 4 miles to the northeast, spotting up to one-half mile, and burned into the Continental Fire. Red/Shoshone is now 52,220 acres.

From August 20 to 24, the fire continued to burn hot and spread along the west flank near Shoshone Lake. Four crews built a fuel break along the Old Faithful Highway to prepare for a possible burnout to prevent the fire from escaping to the north along Yellowstone Lake. Both water and retardant drops were used along this perimeter on August 23. Crews also worked along the South Entrance Highway, where spots burned actively one mile south of Grant Village and on both sides of the road for several miles north of Lewis Lake. One crew, 3 engines, and a water truck worked along the road, falling snags in the morning and then patrolling during the afternoon burn period when the fire crossed the road.

Grant Village and Lewis Lake Campground were evacuated again on August 21. The extreme behavior and proximity of the fire made the reburn

potential too great in the developed areas to allow them to be occupied. Also, the road was closed intermittently, making transportation unreliable at best.

The Falls fire burned into the south flank of Red/Shoshone sometime around August 24. The acreage of the whole Snake River Complex was 88,326 that day, with 631 people, and the cost to date was \$5,431,788.

Red Fire

The Red Fire started from lightning and was first reported at 1458 on July 1 by the Mt. Sheridan lookout. It was located on a forested slope on the southwest side of Lewis Lake. Yellowstone National Park declared it a prescribed natural fire. From July 2 to 12 the fire was under daily observation by the Mt. Sheridan lookout and by Helicopter 1. Rangers from Grant village maintained the fire from the ground until regular monitors could be assigned. On July 7, two fire monitors were assigned to patrol daily on foot. At 1659, they reported trees torching up in the center of the fire and some other spots burning outside the main fire perimeter. On July 12 the fire was 630 acres. From July 13 to 21 the fire continued to spread slowly, creeping on the ground into an old burn on the south and showing more activity in heavier fuels. Sizes were: July 14, 630 acres; July 15, 700 acres; July 16, 863 acres; July 17, 940 acres; July 18, 980 acres; and reaching 1,200 acres on July 21.

Monitoring continued as the fire grew, and plans were developed for confinement on the southeast flank to protect the Lewis Lake Campground. The strategy was to burn out fuels between the fire's southeast flank and the Lewis River to reduce potential of torching and spotting across the river.

On July 21, the Red, Shoshone and Falls fires were declared wildfires under one command (Snake River Complex), and a Type I overhead team was requested.

The fire grew significantly to the north and the southeast on July 22, forcing the closure of the Lewis Lake Campground. Monitoring continued. On July 23, Dave Poncin's Type I Overhead Team took over management of the Snake River Complex. Their primary objective was to deflect the fires around all developed areas. Concern with the Red Fire was to protect the Lewis Lake Campground and the South Entrance Road corridor. A large column of heavy smoke was observed by the Fire Behavior Analysts who were making an initial assessment of the fires. The Red fire burned approximately 1,200 new acres, for a total of 2,800 acres.

On July 24, FBA's noted several spot fires burning well outside the main fire perimeter today. They observed that spotting seemed to be the key factor in the spread of the fire. There was not a well-defined wall of flame making a steady advance, rather, the fire showed a leap frog pattern, spotting ahead, burning together then spotting some more.

Four crews were holding the line which had been burned out south of the campground the night before and began cutting snags along the highway. Helicopters flew tactical and logistical support.

The fire burned the area between the river and the highway, north of Lewis Falls, and spread out both north and south up the broad slopes of the Red Mountains directly east of Lewis Falls. A small finger of fire started up Aster Creek.

Three crews, 5 engines and a Mark III pump crew mopped-up around Lewis Lake Campground, and completed burning out between the highway and river, north of Lewis Falls. The fire made a major run to the northeast burning nearly 7,000 acres and advancing 3 to 4 miles in as many hours. FBA's observing from the road reported a crown fire that ran independent of surface fire and topography. It ran downhill to the northwest all the way to Lewis lake from the slopes of the Red Mountains and, in another head, ran northeast up Aster Creek almost to the Heart Lake Trail. Flame lengths were 150 feet, or about twice the tree crown height and a convection column rose 25,000 to 30,000 feet topped by a cumulus cap. Judging from the sound, the observers thought a fire whirl may have developed in the Aster Creek drainage, but smoke prevented their seeing it. Area burned reached 10,500 acres.

After its major run on July 25, the fire remained fairly docile for the next five days. Unburned fuels within the perimeter continued to torch and burn out but very little additional acreage was consumed. One crew continued to mop up and patrol around the campground. On July 28, three saw teams cut 1,000 snags from along the South Entrance road. On July 30, planners felt good enough about the mop up to pull the hoselays from the campground.

From July 31 to August 8 was a period of increased activity which brought a steady increase of acreage burned. On July 31, the fire advance about 2 miles around Factory Hill and over the Witch Creek drainage toward the Heart Lake Patrol Cabin. Observations this day mention spotting up to one-half mile ahead of the main front. In the afternoon, a squad of 6 was flown in to protect the cabin; they stayed until the fire had passed and mop up around the cabin was completed on August 6.

On August 1, the fire made a rapid advance, burning another 3,000 acres, and slowed down only when it ran into a 1981 burn. This was the same day the Shoshone fire made a wind driven run that was stopped by Yellowstone Lake.

On August 5, the fire was 16,500 acres and had reached the Continental Divide. On August 6, it was 18,000 acres and moving north and east toward the Shoshone fire in the vicinity of Riddle Lake. On August 7, it was mapped at 20,300 acres, and on or about August 8, it burned into the Shoshone fire. The first combined acreage estimate was made on August 9, at 48,662 acres.

Falls Fire

The Falls Fire was initially observed by smokejumpers on July 12, northeast of the Grassy Reservoir, one mile north of the Yellowstone National Park boundary. A fire management evaluation determined the fire should be allowed to burn naturally unless there was a major increase in size to the south toward the boundary with the Targhee National Forest. The fire was put under observation by the Mount Sheridan lookout and by aircraft. The Targhee National Forest was informed. Modified suppression was considered for the south flank to keep the fire within The Park and on July 16, two prescribed natural fire monitors were instructed to scout the south flank for movement in that direction. The fire covered 140 acres on July 16.

On July 17 an FSA was prepared, recommending containment of the south perimeter to prevent spread into Targhee National Forest, with fire being allowed to spread naturally to the north. The Park Service initiated active containment of the south flank of the fire today. The Alpine Hot Shot crew was instructed to contain the southern edge of the fire using light hand tactics, that is pumps, hose, and cold trailing with a minimum of damage. The Bureau of Reclamation approved use of Grassy Reservoir as a water source for bucket dips. The north flank was allowed to continue burning as a Prescribed Natural Fire. Both the east and the west flanks burned actively today in strong west/northwest winds; the west side backed into the wind, burning in heavy fuels with the fire growing to 210 acres.

On July 18 and 19, the Alpine crew used both direct and indirect methods in its attack on the fire. The southwest corner was contained using water and direct hand lines and indirect line was begun along the south boundary extending toward the Beula Lake trail. Fire activity continued much as on July 17, with some spread to the south and northeast.

The crew's instructions were still to strengthen the south and southwest flanks while allowing the north side to spread. Water handling equipment and extra pumps were ordered for tactical support as the crew prepared for a planned burnout along the line tomorrow. Fire spread was to the south and northeast.

On July 20, burnout started along the southeast flank. A second crew helped with burning, holding the line, and patrolling for spot fires. A portable pump was put in place and a Forest Service engine stood by the Grassy Lake road. A helicopter with a bucket provided logistical and tactical support. Besides this planned burnout, the fire showed some activity and movement to the northeast.

The burnout operation continued the next day along the Beula Lake Trail with one more crew to help hold the 3 miles of line. The helicopter again provided support for the ground crews and the engine continued to stand by on the Grassy Lake road. Gusty west winds pushed the main fire south and east toward the burnout. Crews were pulled off the line during the afternoon burn period because of extreme fire behavior.

On this day the Falls, Red and Shoshone Fires as well as Grant Village Structural Protection were all put under one command. The fires were designated wildfires and suppression was ordered. This did not change the immediate strategy or tactics much on the Falls Fire, since efforts to control the south and east flanks had already begun. The fires collectively became known as the Snake River Complex and the Falls Fire was designated Division D. A Type I Overhead Team was ordered for management of this incident.

The burnout continued, on July 22 tying together the gap from the July 21 fire run and the July 21 blackline. Six crews patrolled the south boundary, prepared safety zones, and secured escape routes. A helicopter was again flying tactical and logistical support.

Strong winds, on July 23, today caused the fire to spread rapidly and test containment efforts. Acreage grew from 385 to 2,200 acres, but the fire did not cross the Park boundary. The perimeter now ran about 1.5 miles along the south boundary from the Beula Lake Trail west to the bend in the Falls River, then north and northeast just west of the Falls River for several miles, then back east to Beula Lake and south down the Beula Lake Trail to the boundary. It would stay in approximately these boundaries until August 1.

Dave Poncin's Type I team took over management of the Snake River Complex today.

Activity subsided today and just two crews were held to finish the burnout on the southwest flank of the fire as other crews were pulled to defend Grant Village. Although there continued to be torching and burning inside the perimeter, activity on the fire remained quiet from July 25 to 28 during this period and very little spread occurred. One crew remained to mop up and patrol the boundary.

Just one engine was assigned for patrol and mop up July 29 when the fire broke through the east flank in a small slop-over southwest of Hering Lake. Three crews and one engine were sent in the next day to mop up the break and to patrol other flanks of the fire. On July 31, two crews remained and continued to mop up at least 2 chains into the burn. One crew, supported by bucket drops worked the fire for the next two days. A saw team came in on August 2. On August 7 gusty winds caused a slopover on the west flank, which was contained. In the following days, crews continued to patrol and mop up the southern flanks. On August 11, a second crew and an observer were assigned to help with that work. Considerable hail fell on the southern part of the fire on August 13. Aerial monitoring continued by helicopter.

On August 17, four crews were reassigned to the Falls Fire, now called Division A of the Snake River Complex. They set up hoselays and used bladder bags north of Beula Lake in an attempt to pinch off spread to the northeast. This effort was not successful and the fire made significant gains over the next several days. On August 18, it moved over a mile to the northeast in a mile wide swath. On August 19, it spread out and moved

another one-half mile. On August 20, it ran about 1 1/4 mile in a much narrower band, and on August 21, it moved another mile to the northeast and within one-half mile of the South Entrance Road. It crossed the Lewis River on August 23, covering 6,720 acres, and burned into the south flank of the Red fire on August 24.

Continental Fire

The Continental fire was reported July 29 on the west side of the South Arm of Yellowstone Lake. It was on an east-facing slope in dense forest. The fire management evaluation determined that this lightning fire would be allowed to burn with monitoring from the air. The Continental Fire was attacked by a park crew on July 31, but the crew was pulled off the fire because of extreme fire behavior and lack of support resources.

The fire grew slowly and steadily in size, backing upwind and upslope to the southwest. Estimated acreages show the growth as 2,432 acres on August 12; 2,442 acres on August 13; 2,442 acres on August 14; 2,607 on August 15; 2,753 acres on August 16; 2,850 acres on August 17; and 4,240 acres on August 18.

Ridge Fire

The Ridge Fire was first observed by the Mt. Sheridan lookout on August 4. It was located one mile west of the South Arm of Yellowstone Lake, due south of the Continental fire on an east facing slope. A fire management evaluation declared that extreme fire behavior conditions existed at the time which meant that initial attack by smokejumpers or helitack crews would have required much retardant support. Since the fire was contained to the east and was close enough to the Continental Fire that it would soon be engulfed, no suppression action was taken. Ridge Fire was engulfed by the Continental Fire on August 18 and merged with Red/Shoshone the next day.

SNAKE RIVER (complex)

About August 8, the Red and Shoshone Fires burned together, first near the Continental Divide south of Riddle Lake and later in the area north of Lewis Lake. Red/Shoshone burned into the Continental/Ridge Fire on August 19. The Falls Fire moved steadily northeast, crossing the Lewis River on August 23, and ran into the south flank of the Red Fire about August 24. At this point the Snake River Complex covered approximately 88,326 acres. Primary management objective remained protection of developed areas, including the power line corridor, the South Entrance Highway, Grant Village, West Thumb, Lewis Lake Campground, Shoshone Outlet Cabin, Heart Lake Patrol Cabin and the South Entrance Ranger Station and residences. Suppression efforts were to be tactically sound, yet light on the land. The fire was to be prevented from making further advances on its northwest, west and south flanks.

On August 24, there were 631 people including 18 crews, 19 engines, 1 water tender, and 4 helicopters available to the Snake River Complex. On August 30 the 1st Battalion, 52nd Air Defense Artillery from Fort Lewis, WA

was brought in, trained in fire fighting techniques and safety and put on the lines, bringing the total number of people working directly on the Complex to 998. Of this number 262 were overhead handling planning, supply, logistics, first aid, food, finance, security and other needs of the camp set up in the Grant Village Campground. On August 27, Terry Danforth took over as Incident Commander.

From August 24 to September 1 the Snake River Complex grew tremendously in acreage. Temperatures ranged in the 70's, humidities from low to mid-teens, with winds about 10 to 20 miles per hour. Once the Falls Fire crossed to the east side of the Lewis River Canyon it travelled very quickly. A strong north wind on August 26 pushed it south onto the plateau between the Lewis and Snake Rivers almost to Forest Lake; by September 1 it had moved as far east as Heart Lake. At the same time, the Red Fire spread eastward from Heart Lake across Chicken Ridge, past the Continental Divide and onto the Two Ocean Plateau. Snake River Complex merged with the Mink Fire on August 29 near Badger Creek. The perimeter of the Snake River Complex was estimated at 136 miles on August 31.

Despite this rapid easterly spread, priorities directed that work be concentrated on the western and southern flanks. Line was built and successfully held against westward advance in the area of Propositon Creek on the southwest of the fire. Two to four crews plus several saw teams were spiked here. Utilizing daily helicopter bucket drops, the line was patrolled and mopped up from here south around the perimeter from August 31 until September 14 when no more hot spots could be found.

Engines and crews strengthened a secondary line along the South Boundary Trail from the Beula Lake Trail east to the 1987 Polecat burn (which straddles the Park boundary for almost 2 miles), Then tied the east side of Polecat to the South Entrance with hoselay. In addition, fuel reduction was begun around the Snake River Ranger Station.

Three crews, five engines and four saw teams built line from the Lewis Divide Road across to Spirea Creek to prevent the fire from moving further south along the South Entrance Road, using helicopter bucket drops to cool spots along the line. High winds on August 30 caused the fire to be very active along this line just west of the road in Lewis Canyon, and engines patrolling the highway had to deal with many fallen snags south of Lewis Lake.

On August 31, two crews and one saw team were flown in to build a line from Beula Lake to the hot springs about 3 miles to the northeast. Crews remained spiked out at the Beula camp for two weeks. Bucket drops were used to cool down hot spots along the line.

The other main concern during this time was the northwest flank of the fire, the 7-mile perimeter between Shoshone Lake and Duck Lake. For 4 days, from August 25 to August 28, 18 crews and 8 saw teams built hand line and established a hoselay the entire distance, and mopped up the line 300 feet back into the black. They also built a modified fuel break along the Old Faithful Highway. Helicopters provided bucket drops daily where they were

needed along the line, and retardant drops were utilized on August 25. On August 27, three water tenders and 1 crew were assigned as a hydraulics division to take charge of the completed hoselay.

After the initial building period along this northwest perimeter, crews were released to other priority areas. Remaining crews mopped up 1,000 feet into the black, patrolled the line, and began carrying out trash, extra hose and surplus equipment. The South Entrance Highway and Lewis Lake Campground, closed since August 21, were opened again on September 1. As of September 1, 958 people were working on the Snake River Complex, 156,545 acres had burned and the cost to date was \$7,712,800.

From September 2 to 5 the weather was dominated by a strong high pressure system producing strong inversions and light southwest winds in the afternoon. A heavy inversion lasted most of the day on September 2 and kept fire activity relatively low. Ten regular crews were demobilized on September 3 when the military crews started working on the lines.

Crews spiked out on the line around Proposition Creek on the southwest perimeter were boistered by two military crews on September 3. They began constructing direct line along the edge of the burn from Proposition to the northwest, mopping up 300 feet into the black as they went, and using bucket support as necessary.

Northeast of Beula Lake, two army crews and seven saw teams were added to the force working on the line to the hot springs. Hot spots kept two helicopters busy dropping water on September 3 and the fire remained hot in this area. While the more experienced crews constructed line, the military crews patrolled and mopped up as conditions allowed.

On the south perimeter three batteries of soldiers (120 each) built and strengthened line. Five engines continued patrol and mop up along the highway from South Entrance to Lewis Canyon.

The northwest perimeter was fairly quiet on September 2 and 3. On September 2 one crew patrolled for smokes and carried out litter and equipment. On September 3, a 1-1/2 acre spot fire was observed outside the perimeter. For the next two days an army battery of 108 people lined and mopped up this spot.

In Divisions B and D, three military crews, six engines and up to eight saw teams worked to keep the Old Faithful and South Entrance Highways open. Ten engines on loan from the Huck Fire were on stand-by at the Snake River Ranger Station for structure protection.

Up through September 4, air operation had dropped 932,000 gallons of water and 256,000 gallons of retardant on the fires of the Snake River Complex. As of that date, 170,600 acres had burned and a total of 715 people were working.

September 6 to 7 strong, gusty, erratic southwest-to-west winds predicted for these days came in much as expected and produced extreme fire behavior. Both the Pitchstone and the plateau east of the Lewis River were

active Tuesday and Wednesday. The Huck Fire burned up the north-south trending portion of the Snake River drainage and into the Snake River Complex on September 7. Flame lengths 100 to 200 feet were reported by helicopter pilots, fire whirls were observed and intense localized firestorms occurred. The South Entrance Highway and the Lewis Lake Campground were closed on September 7.

Crew assignments and objectives remained largely the same these 2 days despite increased fire behavior. Crews from the Beula Spike camp continued to build and hold line on the southwest corner of the fire. Line building continued along southern perimeters, and with the help of many bucket drops the constructed line held. The same was true along the northwest perimeter where crews completed mop up, flush-cut all stumps along the fire line and proceeded with rehabilitation along the power line. Size of the Snake River Complex increased slightly to 180,000 acres.

From September 8 to 10 the gusty, erratic winds of previous days moderated some but the fire continued to be active on the plateau between the Lewis and Snake Rivers, in the Lewis River Canyon, and in islands of unburned fuels west of Lewis Lake. Along the east and north edge of the Pitchstone the fire was slowed by extensive treeless areas. Fire behavior was still predicted to be extreme. Reconnaissance flights showed that the Huck Fire had burned together with the Snake River Complex sometime around September 8.

Crew assignments and objectives remained much as before; the one big change in this period was the designation of a new division along the south perimeter east to the plateau above the Snake River. On September 8, two regular crews, two military crews, and five saw teams built direct line from the South Entrance Trail to east of Forest Lake. On September 9, crews finished building hand line and hoselay along the Lewis River and tied it in with the line built the day before.

Light rain and snow fell over the Snake River Complex from September 11 to 13, with temperatures in the 30's and 40's. Crews continued mop up and patrol in all divisions with instructions to work on hot spots until they were completely out. Probeye monitoring continued.

From September 14 to 24 cooler temperatures and occasional moisture (snow on September 18) kept fire activity low. Aerial Probeye monitoring still found occassional heat in Division J, but otherwise there were only a few hot spots and none of them were near control lines. Pitchstone, Beula, and Forest Lake spike camps were closed on September 14 and Polecat spike camp the next day. Hoselay was pulled from the northwest perimeter and rehabilitation work started there. Water bars were constructed and trash and equipment picked up by crews as they walked out. Aerial Probeye monitoring continued.

Fuel modification continued in the Fishing Bridge/Lake Village area and along the power line from Lake south. In addition a sprinkler system was set up around both to protect against fire coming from the west. Crews continued fireline rehabilitation, snag felling and pile burning.

The Snake River Complex was declared 100 percent contained on September 19, at a size of 224,000 acres with 506 people working the fire. Military crews were demobilized on September 25 and two civilian crews were left to do rehabilitation work. Total cost as of October 1 was \$10,014,000. No serious injuries occurred and no fire shelters were deployed in 2 1/2 months of suppression.

CLOVER-MIST

The Clover-Mist Fire was designated as a complex on July 23, originating from several lightning fires in northeastern Yellowstone National Park. It was comprised of Mist, Clover, Raven, Lovely, Shallow, Fern, and Sour Fires, which all began as prescribed natural fires in Yellowstone National Park. The southern perimeter of the fire extends from Bear Creek in the Park to Pahaska Teepee in Shoshone National Forest. The eastern edge borders the Sunlight Basin Road. The fire's northern edge reaches from Pilot Creek just outside the Park boundary to Big Moose Lake in Shoshone National Forest. The western perimeter extends from Sedge Creek in the south to Amphitheater Mountain in the north. Elevation ranges from 6,500 to 10,000 feet. As of September 28, the fire was 89 percent contained at 387,400 acres and total cost was at \$19,027,550.

Fire Chronology and Management Actions

The Mist Fire was started on July 9 by lightning and was designated a prescribed natural fire by Yellowstone National Park. A Fire Situation Analysis was completed on July 17. The strategy alternative chosen was to keep the fire as a prescribed natural fire, confined within natural barriers and monitored on a regular basis. This choice was based on the current moderate fire behavior. The weather outlook for above normal temperatures, low humidity and below normal precipitation was recognized. At this time, the fire was at 1,200 acres and was burning in continuous fuels consisting of lodgepole pine, whitebark pine, Engelmann spruce, and subalpine fir. The Mist Fire grew to about 2,000 acres during the strong winds of July 13 to 21. It became a wildfire on July 21 and combined with the Clover Fire on July 22.

Lightning started the Clover and Raven Fires on July 11, and they were both designated as prescribed natural fires. A Fire Situation Analysis was prepared for the Clover Fire on July 12. The alternative chosen was to keep the fire as a prescribed natural fire with regular monitoring of fire size, behavior and growth potential. Special concerns identified were the possibility of smoke and fire spread into Cooke City and onto adjacent National Forest land, private land holdings near the Park boundary and the need to protect backcountry cabins in the Park. Recent moderate burning activity, the completion of hazard reduction around backcountry cabins, effective means of visitor evacuation and road closure, and willingness to accept the risk of fire confinement to natural barriers were the factors which led to the selected alternative. The weather outlook was for continuous above normal temperatures, below normal humidity, and no precipitation.

The Clover Fire grew rapidly. The first major run on July 14 prompted emergency protection of backcountry cabins. Firefighters deployed fire shelters at Calfee Creek Patrol Cabin. There were no injuries and the cabin was saved. By July 15, the Clover Fire was 4,700 acres. Large acreage in the Lamar River drainage burned during the next two weeks, reaching 10,700 acres. Other cabins were protected, and none were lost. Clover combined with Mist July 22. The Raven Fire stayed at about 60 acres until July 24, when extreme weather conditions caused it to join with the Lovely Fire for a total of 1,145 acres. The Lovely Fire was started by lightning on July 20 and was declared a prescribed natural fire.

After the Clover and Mist Fires joined on July 22, the combined fire continued burning east towards Frost Lake, near the boundary between Yellowstone National Park and Shoshone National Forest.

On July 23, approximately 10 miles north of the East Entrance to Yellowstone, the fire moved out of the Park and into the North Absaroka Wilderness on the Shoshone National Forest. The northern end of the Clover-Mist Fire burned eastward up the Miller Creek drainage, toward Canoe Lake. Retardant drops were ordered to slow the fire until crews could reach the fire, a tactic that worked well. Forest direction for fire management in the area east of Frost Lake, under current conditions, was to limit fire size to 1,000 acres and to 500 acres in the area near Canoe Lake. It was determined that the potential for large amounts of burning in both the Canoe and Frost Lake areas was high. A Type I team was ordered.

The Clover-Mist Fire was turned over to Curt Bates' Type I team on July 24. The team set up camp and continued suppression of slopovers and spots, using natural barriers such as meadows and wet areas wherever possible. Low humidities, spotting, high gusty winds and erratic fire behavior caused control problems.

By July 27, the Clover-Mist Fire was 46,825 acres in size. This acreage included 250 acres on the Shoshone National Forest. Nine 20-person crews and two helicopters, in addition to the management team, were actively managing the fire. Total personnel was 228.

The management strategy for that portion of the Clover-Mist Fire on the Shoshone National Forest near Frost Lake and Canoe Lake was guided by "light hand on the land" tactics. These tactics include selected fire suppression and mop up methods which are effective yet leave minimum impact on the wilderness environment. The use of mechanized equipment was authorized but was kept to a minimum. Incident Commander Bates decided to scale back the helicopter ferrying and opted to move supplies into Frost and Canoe Lakes by pack train and forego non-emergency use of mechanized equipment. Five crews worked to contain the fire near Frost Lake and two crews attempted to contain spot fires north of Canoe Lake. Helicopters were used for transporting crews and supplies, and for making water drops. A few retardant drops were made near Frost Lake. The portion of the fire still remaining within Yellowstone National Park was continually monitored and allowed to burn where it was not threatening life and property.

On July 29, the fire size was at 68,035 acres. Of that total, 1,175 acres were within the Shoshone National Forest in the North Absaroka Wilderness. The remainder was in Yellowstone National Park. About 30 percent of the area within that 68,035-acre perimeter was unburned. The 236 firefighters assigned to the fire were reduced gradually over the next few days. Containment lines were completed around the Frost Lake and Canoe Lake areas by the end of shift. Six 20-person crews continued line-building on the fire near Frost Lake along the west flank of the fire to the natural barrier at Pyramid Peak. Two crews mopped up spots near Canoe Lake and one crew hiked 8 miles via the Miller Creek trail to Bootjack Gap. That pass was the most likely area for the fire to spread east across the Absaroka Range divide because of continuous tree cover. The crew built handline as a contingency against further spread of the Clover-Mist Fire eastward into the wilderness. On this date the Raven and Lovely Fires joined together.

A Contingency Analysis for the Clover-Mist Fire was prepared by the Type I team on July 30. This analysis listed actions necessary to keep the Clover-Mist Fire from spreading onto the Shoshone National Forest at Bootjack Gap and at Milepost 74. At Bootjack Gap the required work included burnout from constructed fireline and could include additional retardant drops. At Milepost 74 the work included retardant pretreating the canopy of the whitebark pine trees southeast of Canoe Lake from the trail to the ridgetop. These actions were seen to be necessary when the following "Trigger Points" were reached: when the fire crossed a pre-determined northwest/southeast line west of Parker Peak and/or when the spot fires in Miller Creek became continuous fire. The management option chosen called for 2 1/2 miles of retardant treatment between Thunder and Amphitheater Peaks if the trigger points were crossed by the fire. This option was selected because of the high probability of success as well as the likelihood that the wind would flow from the acceptable direction to make the plan effective. Finally, this option had the lightest impact on the land.

The portion of the fire on National Forest land was declared contained on July 30. Hot dry weather increased fire activity. Another lightning-caused fire, the Shallow Fire, was found July 31 at 100+ acres in Yellowstone National Park. It was located east of Wapiti Lake and north of Pelican Creek, approximately 5 miles west of the Clover-Mist Fire. The Park designated it as a prescribed natural fire. Due to limited resources, fire crew safety, economic considerations and higher suppression priorities, the decision was to allow this fire to be engulfed by the larger Clover-Mist Fire.

By August 1, the Clover-Mist Fire had increased to more than 73,750 acres. Strong westerly winds pushed the fire closer to Bootjack Gap and caused considerable spotting out in front of the east side of the main fire. Even though this expansion occurred inside Yellowstone National Park, it put more of the east side of the Clover-Mist Fire closer to the Shoshone National Forest boundary. There still remained unburned "islands" inside the perimeter of the fire. The combined Lovely-Raven Fire was located a few

miles to the southwest of Clover-Mist Fire at this time, and it was continually monitored.

As of August 1, some crews had been released and reassigned to other fires. Three crews remained on the fire near Frost Lake and mopped up along hand-built fireline extending to natural barriers on Pyramid Peak. A containment line had been completed across Bootjack Gap close to the common boundary between the National Forest and Park. Airtanker drops of fire retardant were dispersed along this line and some burnout was scheduled to reinforce the line. The Type I team declared the fire contained on the boundary between the Forest and the Park and confined inside the Park and started demobilizing 1-3 crews daily. Remaining crews did mop up work and rehabilitated hand-built lines. Some burn out was accomplished.

On August 2 Bates' Type I team demobilized and turned the Clover-Mist Fire over to a single strike team of 20 people under National Park Service management. Two helicopters remained on the fire. The cost of fire fighting at this time was \$600,000.

Lightning started another fire on August 5, the Fern Fire. It was declared a prescribed natural fire and the decision was made to allow it to burn into the adjacent Shallow Fire. The Park Service conducted aerial monitoring of the Shallow and Fern Fires. More crews were put on the Clover-Mist Fire for rehabilitation and mop up work. Helitack crews were available for initial attack as needed.

On August 6 through August 8, crews patrolled the perimeter of the fire from Frost Lake to Hoodoo Basin, mopping up as they went. Crews were also dropped off at Bootjack Gap and Parker Peak.

On August 9, crews cut logs and patrolled the trail from Frost Lake to Lemon City Meadow. Fire fighters also worked to contain a spot on the north side of Cache Creek. The monitors on Parker Peak were replaced and monitoring continued.

On August 10, the Shallow and Fern fires burned together.

On August 11, the Shallow-Fern fires had joined the Clover-Mist Fire. The Clover-Mist Fire acreage was now approximately 94,724 acres. The fire was being patrolled on the south and east flanks. Spot fires were being suppressed on the north flank to keep the fire in the Cache Creek drainage. The fire was very active and water drops were in progress.

The south and east flanks were being demobilized by August 12th. On the north flank a strike team of two crews was mopping up spots and patrolling for further spots. August 13 crews did mop up work between Bootjack Gap and Canoe Lake, and also patrolled Cache Creek. Strong winds caused spotting in the Cache Creek area, but spots were contained.

As of August 15, there were four crews working on mop up and spot fires. The fire was very active on the northern flank and in the Bootjack Gap area. Water drops were being made to aid crews.

The Clover-Mist Fire had grown to 98,000 acres by August 16. The fire was active again on the northwest flank and in the Bootjack Gap area. Three crews made direct attack on spot fires and mopped up on the east flank, with support from helicopter water drops. Six crews made direct attack on the northwest flank to tie line into the Lamar River. These crews were supported by water drops from two helicopters.

Total acreage by August 17 had reached 109,000 acres in Yellowstone National Park plus an additional 1,175 acres on the Shoshone National Forest. The fire was active along the west flank to Fern Lake, but no new runs occurred. Fireline was 80 percent complete on the Soda Butte area; however, unburned portions within the perimeter posed fire potential. Crews tied fireline into the Lamar River, and a direct mop up on all spots was initiated. Fern Lake Cabin protection continued. Crews directly attacked the East boundary on August 18th, with the help of two helicopters equipped with water buckets. No new spots were reported. Crews continued mop up on the Specimen Creek Ridge Trail and near Mount Norris. Pebble Creek Campground was closed to public use and set up as a camp for fire crews. This camp also offered support to the Hellroaring Fire on the Gallatin National Forest.

Direct attack on spots east of the Park boundary continued, with helicopter bucket drops as needed. Two persons continued monitoring the Parker Peak area. On August 19, there was a stopover in the Bootjack Gap area, which crews worked on all day. The northwest corner of the fire was active also, but lines held fairly well. mop up in the Mount Norris area was completed. There was very little heat near the Lamar River or near the southeastern portion of the Specimen Creek Trail. There was some fire reported south of Cache Creek, which hotshot crews worked on, and unconfirmed reports of fire activity near Webb Spring Creek, which could have put fire back into the Mount Norris area. Fire personnel provided support, in the form of engines and maps, to Cooke City. A type I overhead team was ordered on August 19.

As of August 20, the total acreage for the Clover-Mist Fire was 110,002 acres in Yellowstone National Park plus an additional 1,175 acres on the Shoshone National Forest. At 0530, the fire made a 3 to 5 mile run up Needle Ridge from the confluence of the Lamar River to Cache Creek. Crews were moved to the head of the fire, including five new crews. An additional strike team was ordered, and a helicopter was on loan from the Hellroaring Fire. By late evening on the 20th the Clover-Mist Fire had moved northeast. Winds of 40+ miles per hour pushed the fire up to Republic Pass and Thunder Pass. Crews worked through the night between Amphitheater Mt. and Mount Norris in an attempt to hold the fire to the east Cache Creek drainage.

Aluminum bear proof containers for garbage and bear proof boxes for crew breakfasts and dinners were flown into Division A. The Pebble Creek and Eagle Creek campgrounds, and the Specimen Ridge trail were closed. The personnel protecting Fern Cabin were evacuated.

At 1400, on August 20, the Parker Peak monitors reported 30 mile-per-hour winds with gusts to 40 and a relative humidity of 12 percent. By 1530, a spot fire in Timber Creek drainage that had been 10 acres at 0900 had blown up, and a 20,000-foot smoke column was boiling out of the drainage. By 1600, the sun was barely glowing through all the smoke drift from the southwest, lighting was eerie and winds still stormy and gusty. An EFSA was prepared by Yellowstone National Park on August 20 at 2400. The strategy alternative chosen was full control of the east flank, catching the fire within Timber Creek drainage and full control of the west Flank along Thunderer-Amphitheater Ridge. This would be accomplished with handline construction, support with heavy air operations and extensive burning out.

By August 21, 10 crews (approximately 200 firefighters) had been assigned to the northeast portion of the fire. Hot, dry temperatures, low humidities, fuel types, and wind contributed to a 46,500 acre run on August 20. By the end of August 21, there was fire activity along nearly the complete western flank and along most of the top of the eastern flank. Larry Bogg's Type I team assumed command of the Clover-Mist Fire at 1800. An additional 28 crews and 6 engine strike teams were ordered. The Clover-Mist Fire was within 5 miles of Cooke City. The Lovely-Raven Fire joined the Clover-Mist complex.

Fire acreage as of August 22, was 156,502 acres. This acreage included 15,000 acres on the Shoshone National Forest. Fire retardant drops were made across Thunderer Pass. The fire crossed the Park boundary east of Cache Mountain and the Miller Creek Cabin. There were 594 persons at the Mist Fire base camp. Fire fighting was hampered by slow delivery of supplies and equipment. Communication on the fire was difficult because of a shortage of radios.

Another EFSA was completed on August 22 by the Shoshone National Forest. The strategy selected was a combination of direct and indirect attack. It was evident that direct attack alone was impossible due to extreme and erratic fire behavior. Considerations which led to this alternative included firefighter and public safety, cost, protection of valuable resources, private improvements and historical areas.

Fire activity was moderate on August 23 and was generally confined to the existing fire perimeter. Inversions made flying very difficult. Crews made good progress in the Pilot Creek area, along the northern flank. Army troops arrived with a total of 660 personnel. Total personnel on the fire was 1,238. Cost-to-date was \$6,897,000.

As of August 24, there was still no immediate threat to the communities of Cooke City or Silver Gate. A structural protection strike team was working with local residents. Firelines looked good on Thunderer Pass and Republic Pass. There was some fire movement on the east flank. Crews

working in the Pilot Creek area experienced some extreme fire behavior with the fire moving in several different directions for short durations. The Incident Base had been re-located from Pebble Creek Campground to an area near the Crandall Station on the Clarks Fork Ranger District and was quickly being organized.

Acreage figures for the Clover-Mist Fire remained essentially the same through August 25. The fire was considered to be 35 percent contained on this day, with no estimated time of full containment. Incident objectives emphasized suppression activities designed at keeping the fire in the North Absaroka Wilderness and out of timber stands in the major drainages, i.e., Pilot Creek, Onemile Creek, Squaw Creek, and Crandall Creek. Critical resources ordered and again identified still had not arrived. Accomplishment of incident objectives was hampered by tired crews and overhead and a lack of supplies. Implementing R&R programs further depleted resources. Suppression efforts were concentrated on the northern part of the fire, specifically in the Pilot Creek area. Crews attempted to re-establish control lines after the previous day's erratic fire behavior. Pack trains were used to supply crews and to move fire supervisory personnel up major trails in an effort to gather information on fire location. Smoke and haze greatly reduced the effectiveness of helicopters and made reconnaissance of the fire area south of Pilot Creek extremely difficult. The Clover-Mist Fire assisted the Storm Creek Fire by lending several strike teams of crews.

As of August 25, the fire posed no immediate threat to any structures, private lands, or areas outside of the North Absaroka Wilderness. As a precaution, however, a structural protection plan and an evacuation plan was completed for cities near the fire perimeter (Cooke City and Silver Gate) and for rural areas in Wyoming near Squaw Creek and Crandall Creek. Firefighters and support personnel assigned to the fire numbered approximately 1500 on August 25. This included 29 engines (22 located at Cooke City and Silver Gate), 56 hand crews (including U.S. Army troops), 3 helicopters, and 5 dozers.

By August 26, the total cost for fire suppression was \$7,765,120. Fire acreage increased to the south due to north winds and increased in the Pilot Creek area when fire overran a dozer line and jumped to secondary line. Acreage as of August 26th was approximately 167,700 acres. Fireline held along the northeast and northwest flanks of the fire. The fire was now within 1 mile of Highway 296 in the north and within 3.5 miles of structures in Cooke City. Suppression efforts were concentrated along the northeast corner of the fire and secondary dozer line was constructed. An increase in wind caused the fire to become very active. Highway 212 was closed due to fire activity.

On August 27, the fire started a run at the mouth of Pilot Creek. The run was halted through hand crew and helicopter suppression efforts. The fire also started moving slowly up Upper Cold Creek. Fire acres were estimated to be 182,100 and cost-to-date stood at \$8,100,000. There were 1,706 people, 3 helicopters, 29 engines, 6 dozers and 1 water tender on the fire.

On August 27, lightning started the Sour Fire in Yellowstone National Park. It was declared a prescribed fire, and due to its proximity to the Clover-Mist Fires it was allowed to burn into the larger complex.

Major Clover-Mist Fire suppression efforts were being concentrated on the northeastern part of the fire on August 28. Fire was out of the Wilderness boundary in Pilot Creek. Direct and indirect handline was completed in this area, and a burning operation was started to widen existing lines and to remove light, flammable fuels from between the lines and the main fire perimeter. The burning operation was successful along the south line of the Pilot Creek Finger. The structure protection plan completed for cities and rural areas near the fire perimeter was still in place and fire fighting forces remained ready to respond. A voluntary evacuation of three ranches in the area (B-4, RDS, and L Bar T) was in effect. At this time there was some threat to structures in the Squaw Creek and Crandall Creek area.

As of August 29, the Clover-Mist Fire was estimated to be 190,300 acres, and was estimated to be 40 percent contained. The fire had not made any significant progress towards Highway 212. Additional burning was done in the northern Pilot Creek area and preparatory work was accomplished in anticipation of burning along the northwest portion of the fire, in Yellowstone National Park. Dozers worked south in the Clarks Fork drainage establishing line in an attempt to halt any major runs to the east.

Line scouts continued reconnaissance efforts in the Tough Creek and Crandall Creek areas. A hotshot crew was flown into Closed Creek to work on containing spot fires. Safety for firefighters remained a major concern in the deployment of personnel to the southeastern areas of the fire. In some internal areas of the fire the only active effort was aircraft monitoring.

Total fire personnel on August 29, was approximately 1,500, including 52 hand crews (with U.S. Army), 3 helicopters, 7 dozers, and 28 engines. The cost-to-date was \$8,995,000. There were approximately 25 injuries ranging from muscle strains and blisters to chest colds and congestion.

Daily briefings were initiated in Silver Gate on August 15 with National Park and Forest Service personnel present. These briefings continued through the Clover/Mist and Stone Creek Fires as the threat to the two communities became the Storm Creek Fire and not the Clover/Mist. Structural protection planning was initiated in Cooke City and Silver Gate by Cover/Mist personnel and was sustained by these same personnel and resources even though the most immediate threat and subsequent damage was the result of the Storm Creek burn-out operation. The major suppression efforts were concentrated in the northeastern part of the fire, in the Pilot Creek area. The fire still had not made any significant advance towards Highway 212. Retardant drops were difficult. Strong gusty winds and record low fuel moistures created ideal spotting conditions. Increased winds moved the fire 1 to 1.5 miles in the Crandall Creek and Tough Creek drainages.

The evening of August 30, the entire fire was flown by infrared. Subsequent mapping increased the approximate acreage on August 31 to 231,100 acres. The fire was estimated to be 40 percent contained with no estimated time of full containment. The major suppression effort for August 31 was in the Pilot Creek area. Dozers completed line from Pilot Creek southeast to Hunter Peak Ranch, then remained in the area in case a need for them arose. The fire spotted across Highway 212 but crews were able to contain the spots. The highway was closed intermittently. Helicopters supporting crews in Pilot Creek dropped 60,000 gallons of water.

Action was also taken along the southern portion of the Clover-Mist Fire. Approximately 50 firefighters were moved into the Stonecup Lake area on horseback. A spike camp was set up for crews to work out of. Airtankers were ordered to pretreat the area with retardant and slow the southern progress of the fire, but were diverted to other fires. The Mendocino Hotshots, were flown into Closed Creek, completed securing the spots and were flown out. There was still a critical shortage of crews and equipment. Orders for critical resource needs submitted still remained unfilled.

On September 1, crews in the Pilot Creek area continued to improve lines, look for spots, and mop up. On the southern portion of the fire suppression action continued in the Cathedral Peak and Pyramid Peak area. Additional fire fighters were also sent into the Stonecup Lake area. In the Crandall Creek and Tough Creek drainages the fire moved another 1/2 mile east and another 1 mile north, to the top of Squaw Mountain. This fire movement presented some threat to structures in the Squaw Creek and Crandall Creek drainages. Crews and engines were staged in the Squaw Creek drainage to look for spot fires and to clean-up (fuel reduction) around cabins.

The most serious injuries to date were a strained back and a lacerated foot. The majority of cases in and out of the medical unit were sinus and cold problems directly attributed to cold weather at night, dust, and smoke. Personnel on the fire was approximately 1,580 and cost-to-date was \$10,200,000. Other resources included 20 engines, 7 dozers, 3 helicopers, and 2 water tenders.

As of September 2, the Clover-Mist Fire acreage was estimated to be 233,700 acres. The fire perimeter was approximately 173 miles, with an average width of 25 miles. There was very little fire movement in the Pilot Creek area as crews continued to improve lines, look for spots, and mop up. Suppression action continued on the southern portions of the fire near Cathedral Peak, Pyramid Peak, and Stonecup Lake. In the Crandall Creek and Tough Creek drainages, the fire continued to progress forward and moved into Tepee Creek.

By September 3, significant progress had been made by crews in the Pilot Creek drainage. Suppression action continued on the southern flanks with crews working in the Jones Pass and Jones Creek areas, looking for spots on the south side of Jones Creek, at the upper end. In the Crandall, Tough, and Tepee Creek area the fire was still moving towards Squaw Creek. Dozers worked in the North Absaroka Wilderness to establish lines from Squaw

Peak to the southeast into Crandall Creek. Winds helped to hold the fire on the ridge and it did not get into Squaw Creek. Overall suppression strategy was to keep the fire within the North Absaroka Wilderness, as much as possible, and out of major drainages that had structures and/or private lands. These major drainages included Pilot Creek, Onemile Creek, Squaw Creek, and Crandall Creek. The critical needs submitted 120 hours before had not changed. There was concern over the lack of replacement crews.

On September 4, engines and three dozers were shifted to Cooke City and Silver Gate as the Storm Creek Fire approached from the north. Evacuation for a planned burning operation was started at 0800. Contingency planning began for structure protection from the east gate of Yellowstone National Park downstream along the North Fork Shoshone River. There was no immediate threat to structures but the potential long-term threat from active fire in the Turbid Lake and Jones Creek areas, particularly considering recent erratic fire behavior, precipitated the Incident Commander's decision to prepare for any eventual threat. A sprinkler system was ordered for deployment in the Pahaska Tepee area.

September 4, was the last heavy day of mop up in the Pilot Creek area, with crews mopping up 1,000 feet inside of the line. Suppression action continued on the southern portion of the fire in the Cathedral and Pyramid Peak areas. Crews worked in the Jones Creek area through the night in order to establish lines during less intense burning periods. On the west side, in the Park, the fire moved into the Turbid Lake area, within approximately 1.5 miles of Yellowstone Lake. There was erratic fire behavior south of Stonecup Lake and around Turbid Lake. Fire fighters were pulled out of this area because of the difficulty in providing logistical support and because weather conditions were deteriorating. Dozers continued to work with hand crews to finish building line to Squaw Mountain. Military crews worked in this area also, cutting line into the North Fork of Crandall Creek.

A rehabilitation team on the Shoshone National Forest began evaluating what activities needed to take place immediately, and what long range activities needed to be looked at, in an effort to minimize effects of not only the fire, but fire suppression activities as well.

As of September 5, the Clover-Mist Fire included approximately 237,900 acres within its perimeter. Much of the area within the firelines had not been burned but would periodically burn out as weather conditions changed. The perimeter of the fire stretched from near Mary Bay in Yellowstone Lake northeastward to nearly Cooke City, MT. Fire pushed hard against the North Crandall Creek line and burned on the ridge between Crandall Creek and Squaw Creek. Crews were removed from the ridge, and airtankers and helicopters were used to knock the fire down. A 200-acre "slopover" breached the dozer line at the head of Squaw Creek. Other areas on the fire remained fairly inactive. Cost-to-date was \$11,600,000. Total personnel was 1,493.

On September 6, a dozer line was completed around the 200 acre "slopover" at the head of Squaw Creek. Unburned areas within the 200 acres were burned out to eliminate fuels inside the line. Existing firelines in the area were strengthened.

The fire was spreading slowly southeast of Stonecup Lake toward Silvertip Peak and southwesterly from Turbid Lake toward Lake Butte. Military personnel completed a fireline from the highway northeasterly along Cub Creek to the ridge between Jones Pass and Crow Creek Pass. A 300-person camp was set up at Eagle Creek Campground for coordination of the suppression effort along the southwest flank of the fire. Very poor visibility all day severely limited air operations. There was heavy commitment of resources to Cooke City and to Silver Gate for structure protection.

The weather forecast for September 6, called for possible strong surface winds from the west as a weather front passed over. Late in the day the Clover-Mist Fire experienced extreme fire behavior. Unexpectedly strong winds blew from precisely the right direction to drive the fire into the heavily timbered Jones Creek drainage where it was capable of burning hot enough to spot a mile or more ahead of the main fire. That leapfrog effect enabled the fire to travel several miles in just a few hours. The fire made a 19 mile run east and south from the head of Jones Creek. An estimated 40,000 acres were burned between 1200 on September 6, and 0200 on September 7. The fire advanced rapidly to within 1.5 miles of the Pahaska Tepee and Shoshone lodges about two miles east of the east gate to Yellowstone National Park. The North Fork of Shoshone resort area, located about 50 miles west of Cody, was evacuated.

The proximity of the fire to structures along the main highway between Cody and Yellowstone National Park came as a surprise to Shoshone National Forest officials. Fire management personnel from Clover-Mist had been preparing a structure protection plan the past two days. Strong winds moved the fire from ridgetop to ridgetop in an easterly direction. The area was heavily screened by dense smoke from the Clover Mist Fire and other fires, which made detection of the rapid spread difficult.

Reports of flames at the mouth of Jones Creek and proceeding south along the North Fork Shoshone River began pouring into the Cody Volunteer Fire Department and Shoshone National Forest at about 2000 hours. The reports were quickly confirmed and the fire department dispatched five fire engines to the Pahaska area. At least 10 additional engines were ordered statewide and more than 200 local fire fighters, U.S. Army troops, and other fire-fighting personnel assigned to the Clover-Mist Fire worked to save structures in the area. They were supported by two dozers, 13 engines, and three foam trucks. Another 200 fire fighters, including military personnel, were ordered.

The highway from Cody to the east entrance gate to Yellowstone National Park was closed soon after fire suppression forces began arriving. Local lodge owners and summer home owners were allowed past the roadblock about 30 miles west of Cody to remove their belongings.

Members of the Incident Management Team in charge of the Clover-Mist Fire had been working with residents of the North Fork corridor to prepare a contingency plan in case the fire spread into that part of the Shoshone National Forest. However, based on the fire behavior of the previous days, fire officials had not expected the fire to reach the Pahaska area for three to four days.

After midnight, on September 7, the winds abated and slowed the spread of the fire toward the resort lodges. People and equipment continued to arrive. Six 20-person hand crews were transferred from the Wolf Lake Fire in Yellowstone national Park to Pahaska. They reinforced the crews who worked during the night cutting line around Pahaska Tepee Lodge, Shoshone Lodge, and the east entrance gate to the Park. Crews burned out from those lines to remove fuel from the area between the advancing fire and the buildings in its path. The Clover-Mist Fire breached dozer lines on the north flank around Squaw Creek. The fire spotted out of Squaw Creek into Onemile Creek. Several summer homes near the mouth of Squaw Creek were evacuated.

To the north, the Storm Creek burnout spotted around Silver Gate and Cooke City. Strong westerly winds continued along with high temperatures and low relative humidites. The Clover-Mist Fire continued to make runs in the Jones Creek and Pahaska Tepee areas. By September 10, estimated acreage on the Clover-Mist Fire was 328,100 acres. Exact acreage determination was made difficult by heavy smoke. Resorts in Crandall and in the North Fork of the Shoshone continued to be threatened.

Fire damage to property from the Clover-Mist Fire occurred in the Crandall Creek and Squaw Creek areas. Damage reported includes 17 trailers, 5 residences, 3 outbuildings, 1 store, 2 vehicles and 2 boats.

Overhead personnel sent from the Crandall Base Camp to help in the Pahaska area remained down at Pahaska to manage the operations there.

By September 11, an infrared flight had been flown and mapped acreage for the Clover-Mist Fire at 328,600 acres. The fire was still burning actively north of the east entrance to the Park. Fire had passed Cooke City on the north side of the highway. Structures were still under threat in the North Fork of the Shoshone, at the east entrance to the Park, and in Sunlight Basin. There were approximately 1,500 people on the fire. This figure included 40 crews. Other resources included 89 engines, 16 dozers, 3 helicopters, and 13 water tenders.

A large upper level trough of low pressure moved through the area in the afternoon and evening. Cooler temperatures and higher relative humidites, combined with snow and light rain, reduced the fire spread rate. There was a need for more overhead at the Pahaska camp to manage the operation on that end of the fire. Instead of bringing in individual people managers suggested that a Type II team should be ordered to head up the Pahaska end. A Type II team arrived on September 11 and began transition.

The Clover-Mist Fire was mapped by infrared and digitized. As of September 13, the acreage within the 260 mile fire perimeter was 411,500 acres. A closed low pressure system remained over the Great Basin providing cool, unsettled weather. Rain and snow fell on most portions of the fire, with up to 8 inches of snow in some areas. With the change in weather crews began direct attack on the fire, mopping up along most of the 260 mile perimeter. The overhead managing crews at the south end of the fire (Pahaska Tepee) turned their operation over to the Type II team at 0800. The team was working out of Blackwater Lodge, but were still assigned to the Clover-Mist Fire. People on the fire numbered 1,724, including the new resources at Blackwater ICP. Cost-to-date was \$15,530,000.

By September 14, the Clover-Mist Fire was 65 percent contained, suppression efforts had become less complex, and cooler weather had slowed the rate of fire spread. The Type I team had discussed with Shoshone National Forest and Yellowstone National Park personnel the possibility of turning the fire over to a Type II team. It was agreed that this should be done. A Type II team would be brought in on September 15 and go through transition with the Type I team on September 16. The fire would be managed as 3 segments: (1) The Type II team at Blackwater, (2) The Type II team at Crandall, and (3) National Park Service management of the Yellowstone National Park segment of the fire.

The number one priority continued to be firefighter safety and protection of structures along the North Fork of the Shoshone River, in the Clarks Fork River area, and in the Sunlight Basin. Direct attack on the fireline continued in the Pahaska, Crandall, Turbid Lake, and Sunlight Basin area. There were 1,514 people assigned to the fire. No serious injuries were reported.

On September 15, the Clover-Mist Fire was estimated as 70 percent contained, with 128 miles of fireline built. Suppression efforts were based upon least cost containment/confinement strategies. Natural barriers and limited firelines were used to the extent possible. The Type II team arrived and prepared for the transition with Type I team on September 16.

There were 1,489 people assigned to the fire with the number one priority being firefighter safety and protection of structures along the North Fork of the Shoshone River. Rehabilitation of firelines began around camp and Hunter Peak. The blasting crew began blasting fireline on the slopover in Division J. No major injuries were reported during this period.

September 16 began the transition between the Type I team and Type II teams. Type II teams consisted of a team at Blackwater (Pahaska Tipi) and a team at Crandall. The Park Service was managing the Yellowstone National Park portion of the Clover-Mist Fire. Demobilization started, with a reduction to 1,396 personnel on the fire.

Line construction continued on the north and south ends, with some fire activity continuing due to winds. The fire was estimated to be 70 percent contained with 131 miles of fireline built. No known increase in fire perimeter occurred during the day.

On September 17, the transition from a Type I team to two Type II teams was completed. The south end of the fire was managed out of Blackwater by Lucore's team and the north end out of Crandall by McDonald's team.

The number of people on the fire was reduced to 901 due to demobilization. Military forces were replaced by 18 crews of AD hires.

Line construction continued on the north and south ends, with some fire activity continuing due to winds. The area involved, was estimated as 411,500 acres, with 131 miles of fire line. There 125 trainees on the fire with 30 signed off as fully qualified. The number one priority continued to be firefighter safety and protection of structures.

By September 18, a total of 179 miles of fireline had been completed, with 268 miles to be built. The fire remained at 411,500 acres and was estimated as 70 percent contained. Handline construction continued on the north and south ends and 2,150 feet of line was constructed on the north with explosives. Because of predicted snow, crews were not put into remote areas. Cold and breezy weather occurred, however, the predicted light snow failed to occur. mop up continued in the lower elevations and in area with structures on the north end. mop up occurred in the south end in low elevations and on accessible wildlands.

The area involved remained as 411,500 acres, 179 miles of fire line was complete of the 268 miles to be built. There were 917 people on the fire. There were no serious injuries during this period.

Rehabilitation efforts were started on the cat lines in the area of Drop Point-3 and around the Ghost Creek Ranch. The Forest rehabilitation team met with Plans to set priorities and needs for reseeding. The Park Service relayed their needs for rehabilitating handlines in their branch of the fire.

By September 19, the Clover-Mist Fire was at 411,500 acres in size. Twenty four 20-person crews, 6 helicopters, 5 dozers, 1 water tender, and 17 engine units, in addition to the management team, were actively managing the fire. There were 332 overhead for a total of 929 people on the fire.

The management strategy included protecting structures from fire, controlling spot fires, mopping up, constructing fireline, blasting fireline and working on rehabilitation. A total of 181 miles of fireline out of the 268 were constructed to date. There was no increase in fire acreage.

On September 20, at 0600, the Clover-Mist became the responsibility of the Shoshone National Forest. Before September 20, the fire was under the authority of the Area Command in West Yellowstone.

Handline construction continued on the north and south ends. Line was also constructed on the north with explosives. mop up was continued and concentrated in area containing structures. A total of 929 personnel were on the fire, with 222 miles of fireline, out of the total of 268 miles, were constructed to date. The increase in line built was due to 39 miles of

containment along the south end and 1.4 miles of line built with explosives. Injuries were reported from the south end only. A helicopter crashed about 1715.

The helicopter was a Bell 206 from Apple Valley, CA. It crashed into a shallow pond while refilling a water bucket and came to rest upside down, with only the skids showing above water. The pilot extricated himself from the wreckage and was transported to West Park Hospital in Cody. He was not seriously injured.

September 21 was fairly quiet as a result of higher humidities and precipitation received on the September 20. There were 908 personnel on the fire. Handline construction continued on the northeast end of the fire. Explosives were discontinued for line construction. mop up continued and was concentrated in area containing structures. Helicopter operations were shut down for the day.

A rehabilitation meeting was held in Cody. Alternatives for both long- and short-term projects were discussed. Plans were formulated to treat control lines. The grass seeding will be handled by the Forest rehabilitation team when the seed arrives. A plan for camp rehabilitation will be implemented when the structures are no longer needed.

September 22 saw a resumption of helicopter operations. Handline construction continued on the northeast and in Sunlight Basin. mop up continued around structures and on hot spots close to the line. Weather was warmer, drier, and more breezy. It was estimated that the fire was 83 percent contained. There were 899 firefighters on the fire.

An increase in fire activity occurred on September 23 due to an increase in wind and lower relative humidities, ranging from 13 to 18 percent. There was some fire spread on the northeast corner of the fire, with cold trailing and mop up continued around structures in Squaw Creek, Carnall Creek and the trailer court at the Orr Ranch. An estimated 224 miles out of 268 miles of fire line had been built. A total of 1,018 people were on the fire plus 43 engines, 1 dozer, 8 helicopters, and 10 water tenders.

On September 24, the fire spread an additional 1,050 acres as a result of high winds and low humidities. The spread occurred in the northwest corner of the fire. The area involved in the fire now totaled 412,550 acres.

The northeast corner of the fire was about 3 miles from the southeast corner of the Storm Creek Fire and approaching the Montana/Wyoming line.

Handlines were constructed around spots in the northeast. Cold trailing and mop up continued around structures and hot spots close to the fireline. Efforts were made to get the maximum amount of water from helicopters before noon because of predicted high winds. A total of 999 persons were on the fire.

September 25 brought continued extreme weather conditions which resulted in erratic fire behavior. Winds of 40 miles per hour caused difficult control situations in several areas. However, there was no spread of the fire toward the Wyoming/Montana border in the northeast corner. A helicopter was used to find hot spots along the east side of the line.

Handline construction and cold trailing on the northeast of the fire continued September 26-27, as well as mop up around hot spots close to the line and around structures in other sections of the fire. High elevation infrared indicated a spread of about 840 acres into the Gallatin National Forest in Montana on September 26, and an addition 210 acres burned in the northeast corner on September 27. The Blackwater Camp was completely demobed, resulting in 747 personnel remaining on the fire. Air tankers were used effectively on the northeast corner of the fire.

On September 28, there was a reduction in the area involved in the fire to 387,400 acres. A total of 216 out of 296 miles of fireline remained to be built. The new acreage and miles of line were a result of fireline being plotted by the September 19 infra-red flight and maps being electronically planimetered at Cody, WY on September 28.

Fireline construction continued on the northeast corner of the fire, with cold trailing and hot spotting being continued on all lines on the east side. Structures were actively patrolled. A total of 842 people were on the fire. Air tankers were on standby, but not used. Strategy remained containment/confinement, with no estimated date of completion. Cost of the fire to date was \$19,027,550.

HUCK/MINK COMPLEX

The Huck/Mink complex is comprised of three separate fires, the Mink, Emerald, and Huck, all of which started by lightning in July or August of 1988. As of September 12, 1988, the Huck and Mink Fires were managed as one incident, two days prior to that time the Emerald Fire had been engulfed by the Huck Fire.

The boundaries of the Mink Fire include 1/2 mile east of the confluence of North Fork and Butte Creeks in the Thorofare drainage and Howell Creek, west of Overlook Mountain on the West. The southeast slope of Mount Humphreys is the northern extent, and the confluence of Pacific and Mink Creeks describe the western boundary (adjoining the east flank of the Huck Fire). The southernmost extent of the Mink Fire is described by Enos Creek and Enos Lake, with the total size estimated at 128,400 acres.

The Emerald Fire began near Emerald Lake and was bounded on the southeast by Mink Creek in the vicinity of Burnt Creek. It burned to within 2 miles of the Fox Park patrol cabin on the northwest. The final fire size was 1,520 acres on August 25 when 100 percent containment was reached. However, the Emerald Fire was burned over by the Huck Fire on September 10.

Steamboat Mountain was the origin of the Huck Fire, and it spread northeasterly bounded on the west by the Snake River and Sheffield Creek. The northern spread crossed 1 to 2 miles into Yellowstone National Park in the vicinity of Coulter and Harebell Creeks. Easterly spread crossed onto the Bridger-Teton National Forest for 19 miles and joined the west flank of the Mink Fire, near the confluence of Pacific and Mink Creeks. The southern boundary ran along Pilgrim Creek, Bobcat Ridge, Whetstone Mountain and The Pacific Creek drainage.

Fire Chronologies and Management Actions

Mink Fire

Lightning started the Mink Fire on July 11, in the Mink Creek drainage within the Teton Wilderness administered by the Bridger-Teton National Forest. At about 1430 that afternoon the Fire Management Officer of the Bridger-Teton National Forest flew over the area and noticed four trees burning northwest of Enos Lake near the center of Section 27, T47N, R112W. On Tuesday July 12 an aerial reconnaissance revealed that the fire was 3 to 4 acres in size and was spreading slowly to the northeast. After consultation between the Fire Management Officer, District Ranger and the Forest Supervisor it was decided that the fire was burning under prescriptions set forth in the 1981 revised Teton Wilderness Fire Management Plan. The plan states, "The natural forces of fire, insects, disease, water and all others will be interfered with to the extent needed to protect human life or when the result of not taking action would significantly impact the usefulness of the area to the American people or cause unacceptable damage to adjoining property." No suppression action was initiated. It is estimated the fire grew to about 25 to 30 acres that evening. Daily

monitoring of the fire was taking place, both by air and District personnel on the ground.

An early morning flight, on July 13, revealed that the area was foggy and overcast under an inversion. Another flight that evening revealed the fire size at approximately 100 acres and spreading northeast. Late evening strong winds caused the fire to gain momentum and increase in intensity. Direction of spread was northeasterly by spotting the grassland between clumps of trees.

By July 14 the fire had exceeded 1,000 acres. The Bridger-Teton management team reassessed the situation as required by the Teton Wilderness Fire Management Plan. The fire was still within prescription, however, due to the fire behavior and the extremely dry conditions, it was declared a wildfire.

The fire had burned to the east across Enos Lake Trail and had pushed south across Pacific Creek. It had burned patches of a 15,000 acre blowdown that resulted from a tornado in the area in July 1987. A 2 p.m. flight revealed that a weak cold front had caused winds to fan the blaze and had resulted in a major increase in size, to totaling approximately 3,000 acres. The fire was heading north and east, with very little backing, but also with extremely high potential for moving southward into the patchy blowdown trees along the east side of Enos Lake. It was agreed at the ensuing assessment meeting to request Gene Benedict, Incident Commander, and Francis Mohn, Fire Behavior Analyst, to lead in the development of an EFSA.

The July 15, early morning monitoring flight revealed that the fire was backing quickly into heavy fuels and blowdown and was rapidly moving southeast. By afternoon it had moved an additional mile and had the potential to get into major portions of the blowdown. The fire was over 6,000 acres in size. The potential of the fire to enter the heavy fuels in the blowdown was of major concern due to the threat of spreading rapidly to homes and structures in the Buffalo Valley 9 miles to the south.

Gene Benedict from the Payette National Forest arrived to assist the Forest team in preparation of the (EFSA). Benedict was responsible for completing the Teton Wilderness Fire Management Plan in 1973. The recommended and adopted strategy was to contain the fire on the south flank. A confine/contain strategy was adopted for the remainder of the fire. A control strategy was not adopted due to the high cost, (estimated at \$10,600,000) and low probability of success (50 percent). Following approval of the recommended action Dale Jarrell's Type I overhead team was assigned to the fire. By midnight the fire was 9,130 acres.

The Incident Commander, Dale Jarrell, met with the Forest Supervisor and staff on July 16 and discussed options and strategy. They decided to proceed with a "light hand on the land" strategy, which uses a minimum of digging of fireline and mechanized equipment. Fire suppression and mop up tactics were selected which were effective containment measures, yet leave a minimum impact on the wilderness environment. Wherever possible, natural features such as open meadows, water bodies and rock cliffs would be

utilized as firebreaks. The use of helicopters, water pumps, and aerial retardant could be used, but kept to a minimum.

The fire had progressed to Two Ocean Plateau near Two Ocean Pass on the north and had burned to Enos Lake on the south. The strategy was to work on the south flank of the fire to reduce the risk of the fire spreading to the major blowdown areas to the south. This spread would increase the potential for damage to people and property south of the Wilderness. Ten crews, 4 helicopters, and support equipment and personnel were dispatched to the Mink Fire. An infrared flight over the fire area at midnight, July 16, showed the fire had increased to 12,100 acres.

On July 17, base camp was established at the Black Rock Forest Service Work Center and two spike camps were set up near the southern perimeter of the fire. Additional helicopters and crews arrived and a total of 482 fire personnel were assigned to the fire. The primary effort was exerted to keep the fire out of the major parts of the 15,000 acre blowdown which contained an estimated 100 million board feet of dry, "jackstraw" timber. Portable pumps were used to wet edges of meadows. Helicopters used water buckets to cool hot spots. Crews used back fires and burning out where necessary to slow the progress to the south. Limited use of chainsaws was approved by the Forest Supervisor.

During Monday, July 18, the southern perimeter of the fire continued to back down slopes, with resulting high-intensity fire behavior and spotting. The containment effort was concentrated on the southern part of the fire in an attempt to stop the spread toward residences outside the Wilderness.

Early morning smoke from the fire caused concern to local residents and visitors. In addition to the daily updates in the communities and Grand Teton National Park, an information officer was assigned to Cody to keep that community informed. The fire continued to grow in size and run to the north toward Yellowstone Meadows approximately three miles from Yellowstone National Park. Park officials stated that they were prepared to accept the fire if it should continue on course. A total of 3 spike camps were operating in the Wilderness, with all food, tools, personnel, and supplies being moved by helicopter. Spike camps used Wilderness camping methods required for Class I grizzly bear habitat. Infrared photos showed the fire to be 14,040 acres in size. More favorable weather combined with containment efforts ended the dramatic increases in acreage.

The fire had burned south of Enos Lake by July 19 and continued to be a problem to contain on the south end. Major blowdown was still in the path of the backing fire. The green meadows stopped the spread of the fire, but spotting still occurred. It was burning in a mosaic pattern where unburned areas were mixed in with the burned areas. Estimates were that only about 60 percent of the fuel inside the fire perimeter had burned. The northern head had reached Yellowstone Meadows and was within 2 miles of the Park.

Based on information conveyed by fire behavior specialists, the decision was made to protect Yellowstone Meadows and continue containment efforts on the south flank. Fire was active on the south end and spread

over the established natural fire break, bringing the fire size to 14,847 acres.

On July 20, an amendment was made to the EFSA which included the protection of Yellowstone Meadows as a second priority. Tactics would be consistent with those already established. The south flank continued to be a concern, and crews had not been successful stopping the fire at natural breaks. By the end of the day, 659 personnel were on the scene and 10 helicopters were struggling to keep up with the incredible logistical problem of supplying three remote spike camps and supporting the line containment crews. Hose and some personnel were placed in Yellowstone Meadow near the north end of the fire to assure that the fire did not cross the meadow.

The operations section determined that a large (900 acres) burnout would be necessary to halt southern spread of the fire through the blowdown. The burnout was ignited at 1610, using an aerial ignition device. The results were spectacular. A huge plume of black smoke could be seen for miles and revealed the extreme intensity of the burnout. The column shot up to about 30,000 feet and formed a huge cloud over the fire. The containment line held and crews were able to contain the fire within the burnout area. The "corner" had been turned. Crews remained on the lookout for spots and helicopter bucket drops helped cool snags and flaming islands of timber near the meadows. The south flank would soon be secure. Because of the burnout and the expansion on the northern portion, the fire reached 17,100 acres, the largest fire ever to occur on the Bridger-Teton National Forest.

On July 21, crews concentrated on holding the containment line on the south and all were optimistic that the south flank would hold. Twenty-six crews and 12 helicopters were supporting the effort. A total of 750 people were involved. No spots were discovered outside the line on the south and good progress was made. The north end of the fire continued to creep toward Yellowstone National Park. Crews were on the scene in Yellowstone Meadows working on spots. The Meadows burned partially across during the afternoon.

An FAA control team arrived in the morning to provide assistance with helicopter operations. Stronger inversion conditions existed during the morning and helicopter flights to spike camps and fire reconnaissance were grounded until 1200. Smoke from yesterday's large burnout was reported to have darkened the skies over Cody, WY. An early afternoon reconnaissance reported that all the area surrounding the burnout remained secure. New, increased fire activity was reported in the north head of the fire adjacent to Yellowstone Meadows.

Tom Roederer, Doug Bird, and Brian Stout visited the fire in the afternoon. The fire burned very intensely adjacent to Yellowstone Meadows. Large pockets of subalpine fir, Engelmann spruce, and lodgepole pine had torched and had spread backing into the wind down canyon. Winds were very erratic in the vicinity of the mouth of Atlantic Creek and the Meadow. Southwesterly winds from Atlantic Creek mixed with upcanyon winds in the Yellowstone drainage made for very erratic burning. Spot burning also occurred in the Meadow. Several areas (estimated at a total of 3 to 5

acres) were burning from spotting or as a result of radiant heat from fire in the adjacent trees. Spotting distances were estimated to be approximately one-half mile. Relative humidities were in the mid-teens and this certainly contributed to the ability of the fine fuels in the Meadow to support active fire.

Additional burnout operations took place on the slopes above North Buffalo Fork in the late afternoon. The smoke plume was favorable early in the burn but, influenced by west winds over the ridges, soon threatened spotting across the Creek. Holding action by crews was maintained but was very difficult due to torching, burning intensities, and dense smoke.

Observations of active burning in the stands of trees led to estimations that the fire would spread into Falcon Creek by July 23 or 24. Low relative humidities maintained throughout the night with recovery only to 26 percent. A portable Remote Automated Weather Station (RAWS) was installed on the west side of the fire.

Objectives for July 22 were to continue to hold the south flank and to protect the Yellowstone Meadows. Six category II crews were released. Four additional Category II crews arrived to fill in for the nine crews released July 21 and July 22. Twenty two crews were planned to be in place by the end of the shift. Morning inversions continued to be a problem in moving personnel and equipment.

Forecasted weather and burning conditions called for extreme conditions. Weather continued to be very hot, with low relative humidities and strong winds. Early fire activity was reported in Yellowstone Meadows and the adjacent slope and afternoon winds in the drainage became very strong, blowing from the southeast. This was not expected but was determined to be a result of strong, down-drainage winds in Atlantic Creek that "overpowered" the more northwest up-canyon winds in the Yellowstone drainage. These winds caused the fire to spread along the flanks of the Meadow to the mouth of Falcon Creek by 1800 (distance covered was approximately 1 mile in 4 hours through the heavy timber). Extreme fire behavior was observed by crews in the Meadow, with flame lengths reported at 200 feet above the canopy. This section of fire also backed upslope to the major ridge on the south flank of Falcon Creek and went over the top during the night.

Burning conditions were also very active on the south and southeast end of the fire during this same time period. Crews experienced control problems due to spotting and wind shifts with gusts to 15 miles per hour. Strong down-canyon winds were reported by the Division Supervisor during the afternoon, pushed the fire south to Clear Creek Lake and along the breaks of North Buffalo Creek. These down-canyon winds were not unexpected. A few spot fires occurred across North Buffalo Creek, but were picked up by crews in the area. This area of the fire remained very hot and potential for additional spread to the south and east still existed.

Other areas of the fire that had been relatively quiet for the past few days also began to come to life. Spot fires along the east side of Atlantic Creek in the Daniel Creek drainage became larger and more active. Some additional acres burned in the high cirque and bluff areas in the Third Creek drainage on the west side of Atlantic Creek just over the Divide. Large acreage gains and high intensities were expected if Daniel Creek, Jay Creek, and Senecio Creek became more involved. By the end of the day, 22,025 acres had burned.

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The Incident Commander, Forest Supervisor, and Senator Wallop of Wyoming flew the fire. By the end of the day, 22,025 acrea had burned.

On July 23, the objectives of protecting the south flank and Yellowstone Meadows stayed the same. Fire behavior kept mostly on the ground with only isolated torching, and mop up continued on parts of the southern flank. Pumps and hoses were used extensively to be sure all hot areas next to the line would hold. The northern front was burning hot and about to enter the Park. Crews continued to work in Yellowstone Meadows and lay additional hose. It was estimated that 100,000 feet of hose were in use on the fire. No additional personnel were added to the effort. Helicopters continued to be very important for all aspects of the operation. They constantly shuttled food, supplies, tools and firefighters from the busy helispots at base camp near Black Rock Ranger Station. By evening the fire grew on the north flank to a total of 22,500 acres. The cost now exceeded \$2,000,000.

On July 24, 12 helicopters remained on the fire, with the emphasis on the southeast corner. The southern flank was 90 percent contained and mop up continued. The IC, the Forest Supervisor, Jim Turner and Harold Turner flew the fire in the afternoon. A strategy meeting was held the evening of July 24, and the EFSA amended to include Falcon Creek and the west side of the Yellowstone River in the containment objectives. The R&R schedule was reviewed and demobilization plans were suspended.

A revised weather forecast was read over the radio to the crews and overhead on the line informing them of the chance of strong winds to 25 miles per hour over the ridges during the burning period. This forecast was accurate; afternoon winds were very strong from the west and southwest. Fire behavior became extreme on the north end of the fire in Falcon Creek and one section on the west side of Atlantic Creek in Third Creek. Southwest winds down canyon in Falcon Creek pushed the fire approximately 4,000 feet down the Yellowstone drainage into Yellowstone National Park. Spotting and burning into the meadow became a problem as dry grasses and brush in the meadow were sustaining fire. One spot toward Bridger Lake was

picked up approximately 1 mile away. Torching and spotting were also a problem in the Trail Creek area as the fire continued to spot downslope. One spot fire was also picked up across North Buffalo Creek. Water drops from helicopters were used throughout the day in order to keep the spots under control until personnel could get to them. The fire size was 23,600 acres at the end of the day.

The east side of the fire was active on July 25. Spots in the upper Trail Creek drainage were difficult to hold and some spotting occurred down the slopes toward the upper end of North Buffalo Creek. The Third Creek drainage (north-west side of Atlantic Creek) also did some burning out as fire in the preheated fuels from the past several days finally gained momentum and burned out most of the cirque at the head of the creek. Gusty winds prevailed throughout the afternoon and evening, with some 25-mile-per-hour speeds estimated by line personnel. Maximum support from helicopter water buckets was the primary factor that kept the fire from spreading more than it did.

The northern front of the fire burned actively into the Falcon Creek drainage and extreme fire behavior occurred by late afternoon. Fire spread up the slopes on the north side of Falcon Creek, with some fingers burning to the bluffs. Some of the active burning was in the National Park. Flame lengths were reported to be 150 to 200 feet, and the fire spread along the Yellowstone drainage toward Lynx Creek where very intense burning occurred in several acres of blowdown. Much of the burning and spread was from early evening to very late evening (2330). By the next morning the fire had moved to the mouth of Lynx Creek.

The IC met with Yellowstone Area Command personnel in relation to the Mink Incident coming in under the Area Command. The decision was made that the Mink Incident would stay separate but would coordinate releases and equipment needs. The burned area at the end of the day was 24,400 acres and the fire was considered 87 percent contained.

The primary objective of July 26 was to keep the fire out of Falcon Creek and west of the Yellowstone River. Several slopovers from the previous day's burning occurred on the Falcon Creek side of the ridge. The largest was approximately 15 acres and down the slope one-quarter mile. One hotshot crew was flown in to work the ridge. One crew also worked in the bottom of Falcon Creek.

Thunderstorm winds developed by 1200 and were very gusty and erratic. A thundercell developed northeast of the mouth of Falcon Creek and caused some up-canyon winds in the lower part of the creek, resulting in rapid burning and problems for the crew in the bottom of the drainage. The most active burning in Falcon Creek at this time was on the National Park lands. Helicopters and buckets supported the crews in the area all day.

Cloud cover became 90 percent by mid-afternoon and fire activity settled down as winds became light and relative humidity came up to 40 percent.

Command staff were told at a 1700 strategy meeting to evaluate their needs so that tentative demobilization plans could be made. Park Service representatives met with the IC during the evening in relation to coordinating efforts and sharing information. The fire was considered 90 percent contained.

The emphasis on July 27, continued to be the north flank, specifically to keep the fire out of Falcon Creek and west of the Yellowstone River. Three crews were spiked at Yellowstone Meadows to work the fire edge down the ridge from Two-Ocean Peak. Over 30 miles of hoselays were used to contain the south flank. Fire behavior throughout the day was fairly quiet as cumulus cloud cover and spotty rain prevailed. Thunderstorms became very active in the vicinity of the fire area by 1700 and lightning was quite heavy, more widespread rains occurred over the area by 1900. There was no active fire behavior except for smoldering and burning out of larger fuels. Water drops continued to be used in the containment efforts. The fire was considered 93 percent contained, at 24,680 acres, with about 1,500 acres in Yellowstone National Park and no additional acreage burned at the end of the day. More than 3.5 million dollars had been spent on suppression efforts.

Significant progress was made on July 28 as the weather continued to be cooler, with high humidity and light winds. The objective of the day was to continue to strengthen the line on the south flank and to work the fire edge at Falcon Creek on the north end. A continuing effort was made to bring excess equipment off the line. Rehabilitation work, consisting of clearing fire-felled or dangerous snags from designated trails was done.

The fire was considered 97 percent contained at the end of the day and had not burned any additional acreage. Demobilization plans were developed and a M-L Team list developed for replacing Jarrell's Type I Team.

The objectives of July 29 were to continue to work the Falcon Creek portion of the north end, as well as Yellowstone Point. The south end of the fire was worked with three crews to repair any environmental damage and to bring excess gear off the line. Trail rehabilitation work continued, there was no increase in the fire size and two of the three spike camps were closed. Major demobilization plans had begun. Three Type I and one Type II crews were demobilized with the intention of having six Type II crews remaining at the end of the shift on July 30.

As of July 29, the fire was 100 percent contained/confined. Firelines that had been established using natural barriers and a minimum amount of hand-constructed line had kept the fire from expanding along the 25 miles of containment line from Enos lake around the southern edge of the fire to the North Buffalo drainage and the portion in the Falcon Creek and Yellowstone Meadows areas.

Two spike camps, one located near Clear Creek Lake and the other in Yellowstone Meadows continued to support the six fire crews and four helicopters that remained on the fire beginning Sunday, July 31. A Class II Overhead Team headed by John Combs took over the management of this fire beginning Sunday, July 31. Fire crews continued to mop up hot spots near

the containment line along the south boundary of the fire and in Falcon Creek and Yellowstone Meadows.

On August 1, a strategy meeting revealed that there was still work to do on Yellowstone Point and up Falcon Creek, most of the fire activity was in the Park. Fire activity on August 2 was quiet on the National Forest Lands and very active on the Park Lands. It was cool all day and considerable rain (0.15 inch) fell at fire camp on August 3, but the duff remained dry under the trees. Fire growth occurred only on the Yellowstone National Park lands. Combs' team planned to get National Park Service permission to take some control action using water on the southwest point of the ridge between Cliff Creek and the unnamed creek to the north. The idea would be to use water to protect a line from the point to the Yellowstone river and then fire it out. This effort would be designed to keep the fire from leaving Yellowstone National Park and proceeding up the Thorofare drainage. The plan and response follow:

In order to stop south spread of fire on the east side of Yellowstone River, we intend to insert wetline (hose and staged pump operations) from the river south and east to the north side of Cliff Creek drainage (tying into the west side of the cliff above the meadows). This plan will require the least amount of resources and effort in both meadows and timber stands.

As wetline proceeds, strip firing will be conducted in the meadow and up into and through the trees. In the trees, minimal removal of needle litter and limbing along lines will occur (without going to full control line/mineral soil standards). This will provide a defensible line to fire from and maintain control.

Four helicopters will be required; an aerial command/firing supervision platform, and three bucket helicopters.

The plan was presented to Greater Yellowstone Area Command, Greater Yellowstone Area Incident Commanders, and Line Officers in West Yellowstone, MT, on August 3, and approved in concept by Park Superintendent Bob Barbee, subject to specific location of the holding line on the ground. This plan approved subject to modification to delete the reference to removal of needle litter and limbing. The holding line will be established through the use of water alone, with no disturbance of vegetation, including trees and ground vegetation, and no disturbance of soil.

Considerable discussion of tactics for August 4 occurred at a 1700 meeting on August 3. Rain had slowed the rate of spread to almost zero, flame lengths were 6 inches or less and fuel moistures were up. Those factors led to the idea of backing off from the wet line and firing tactics and to go to direct bucket attack a little farther to the north, near the mouth of Mountain Creek. By 2000 plenty of smoke in the north was again visible from camp.

At 0730 on the morning of August 4, helicopters delivered crews to the Mountain Creek area to take direct attack on the fire at the south edge with assistance from helicopters using water buckets. Visibility was limited in the morning due to smoke. Temperatures were not as severe as they had been. At 1008, fuel moistures for 1 hour time lag fuels were 16 percent; 10 hour, 19 percent; 100 hour, 15 percent; and 1000 hour, 15 percent at Black Rock Ranger Station. The idea of wet line and burnout at Cliff Creek was temporarily suspended until the Mountain Creek action could be tried. The instructions to firefighters at Mountain Creek follow:

- Using water alone for constructing and holding, and fusees for firing, construct a strong black line from bluffs to the river to stop spread of the fire to the south.
- Do nothing to discourage spread of the fire to the north.
- Work ground personnel with one foot in the black or have a clear path to an adequate safety zone (river or burned/green meadow) at all times.
- All personnel will carry tools for safety and for moving fuels.
- No falling of trees, cutting of down logs, limbing up or soil disturbance.
- Maintain adequate separation of aircraft for safety.
- Complete control of all personnel and aircraft at all times.
- Hold line and patrol for spots.
- If forced to withdraw from Mountain Creek, establish secondary control line at Cliff Creek.

At 1600, the IC reported that work was in progress at Mountain Creek using water to try to suppress the fire there. The fire gained approximately 500 acres in that area.

On August 5, operations reported that the fire looked good in the Mountain Creek area. There was some talk of letting crews go but the decision was to retain them for a few more days to ensure control of the fire in the Mountain Creek and the Senecio to Trail Creek areas. Also identified was the large cutting job where high stumps remained.

At 2000, the fire was reported burning vigorously near Mountain Creek and a cap cloud and smoke column were visible from ICP around 1700 to 2000. Humidity was down to 11 percent and the temperature was 78 degrees with southwest winds at 3 to 7 miles per hour.

At 0700 on August 6, high humidity and high winds aloft (40 miles per hour at 14,000 feet) were reported. At 1200, humidities were still high (40 to 45 percent) but winds in the area of the ICP were gusting to 20 to 30 miles per hour. At 1415, Dave Willson, fire meteorologist, called

Yellowstone Spike Camp with a wind advisory for possible 50 mile per hour gusts from thunderstorms. Yellowstone Spike Camp responded that their tables, etc., were just blown over by a 45+ mile per hour gust.

The south Mountain Creek wet line held very well throughout the day. A few of the troublesome spots around Yellowstone Point and Falcon Creek continued to burn, sometimes fairly hot. The fire ran over 3 miles up Mountain Creek on the north side, with spotting distances over 1 mile. No precipitation occurred on the fire. A mule pack string went in today to begin bunching gear left around the fire and to map where rehabilitation, stump cutting, etc. was necessary.

The day of August 7 began with heavy cloud cover. During a 2 hour period approximately .03 inch of rain fell. Fire activity was generally quiet all day except the Mountain Creek area, which put out heavy smoke all day but did not run. Crews made good progress at Yellowstone Point and south of Mountain Creek. Another shower crossed the south end of the fire around 1600.

August 8 began clear and cool but began to warm rapidly by 1000. Winds were light and variable, and relative humidity recovery was good at 76 percent on ridges near the fire. Some small cumulus clouds began appearing at around 1100. Four crews remained with four helicopters and the Type II team. Fire activity was low, but Mountain Creek started to show some smoke around 1600, which was visible from ICP, but no column developed. Operations estimated less than 100 acres had burned in Mountain Creek as of 2000 hours. Temperatures for the day reached 73 degrees and minimum relative humidity was 21 percent, with 12 to 15-mile-per-hour southwest winds. Crews had worked the wet line at Mountain Creek about 4 chains in most places and it was looking good.

Smoke prevailed in the valley on August 9. By 1600, the temperature was 74 degrees on the fire and by 1845, relative humidity had dropped to 16 percent. Fire activity increased in the Yellowstone Point area, with a considerable number of new smokes in the Atlantic Creek area. Also, Mountain Creek became very active by 1300 and fire there started to spread. Results from visual observation and mapping by the Operations Section, at approximately 2030, estimated that the fire had covered approximately 2,000 additional acres in Mountain Creek.

A transition from Combs' Team to Turner's Type II Team occurred on August 10 and 11. A great column of grey/black smoke was visible from fire camp and from the town of Jackson on August 10. The fire size was 22,800 acres on National Forest land and was 100 percent contained. On National Park land, fire size was 10,080 acres.

On August 11, the fire increased in size on National Park land only, by 2,820 acres, to bring the total on National Park land to 12,900 acres. Total personnel numbered 226.

Fire activity was slow on August 12 and 13, with very little enlargement occurring. Considerable rain fell in fire camp and in the fire area high winds with some rain and lightning occurred on August 12. Four fresh crews arrived that day. Relative humidity on August 13 was 29 percent, with light winds and a warm temperature of 63 degrees.

The weather returned to hot and dry on August 14. Wind gusts at the Thorofare RAWS were 38 miles per hour. In the evening the fire burned very hot within the existing fire perimeter in the Howell Creek area of Yellowstone National Park, no increase in fire size occurred.

August 15 began with a clear, sunny, and warm morning. Alto Cirrus clouds were visible and windy conditions prevailed by 1100. The fire was quite active on the northwest corner of the mouth of Joy Creek and it went up Third Creek. It also burned well in Trappers Creek. The cabin in Howell Creek was threatened and fire continued to move up that drainage well. High winds were experienced all afternoon.

At 1930, Trappers Creek, Howell Creek, and Third Creek were burning well. Other places were in good condition. A spot showed up on the line at the south end, near Enos Lake, that had not been apparent earlier, even on infrared photography. High winds had kicked up the fire in places.

Hot, dry conditions continued through August 16. The fire was active on Park lands. On the Bridger-Teton National Forest it was most active in Third Creek where it was not expected to pose a problem. Fire activity was fairly quiet. A new fire broke near Emerald Lake. It was agreed that Turner's overhead team would support the district personnel from the Mink Fire. The fire was very hot on August 17 in Mountain Creek's junction with Trappers Creek and Howell Creek. A spot occurred across the Trident wetline by evening and another spot was found in a fairly safe place near Enos Lake. Action was planned for both spot fires for the next day. The evening yielded nothing but helicopter problems: of the four on hand, one Llama ran out of pilot time; the Long Ranger was down to 4 hours left to fly the Fan Fire the next day; the 212, with six passengers, had an engine fail. It flew to Jackson with for an emergency landing --no one was hurt. No equipment or time was left to get all the troops to Atlantic spike camp. Several firefighters (about 15) spent the night in the woods without dinner, jackets, or lights.

John Chapman reported that the Forest Supervisor wanted the fire suppressed where it came back on the National Forest from the Park in the vicinity of Mountain Creek.

A new overhead team, Jarrell's type I, began the transition on August 18 to take over the Mink and Emerald Fires by 0630 on August 19. A total of 24,062 acres on National Forest land and 16,498 acres on National Park land had burned for a total of 44,950 acres. Some 192 personnel were assigned to the fire and it was considered 95 percent contained.

Six retardant drops and a spike camp drop made it impossible to finish the troop ferry on August 19. The fire appeared to be holding. Five new crews were ordered. The heavy helicopter was not available, but one light and two medium helicopters were received.

On August 20 four more crews were received, two Type I and two Type II. Ten crews in total were moved and total personnel was 300. By 1420, winds increased to the point that air operations were shut down. At 1600, a call was placed to Jackson dispatch to offer four crews to the Hunter Fire.

Staff from Yellowstone National Park called at 1700 to give permission for a spike camp in Yellowstone Meadow north of Cliff Creek. The camp was to be set up using "light hand on the land" ethics. The okay was given to use chain saws to build line in the trees and burn out. Wet line was to be used in the meadows. The Atlantic spike camp reported that the fire in Senecio Creek was blowing out and the column was laying across Yellowstone Meadows. Fire was also heading up Lynx Creek.

Hawk Rest personnel reported that the fire was across Yellowstone Meadows and burning above the cabin. Doyle Nelson called from Grand Teton National Park at Colter Bay and requested that the Mink IC Team take the Huck Fire that had just started and burned onto the forest. Jarrell's Team agreed to take it.

The Mink Fire burned across Yellowstone Meadows and into the Thorofare drainage on August 21. Spread was to the east but posed a possible threat to the south. Priorities were now on structures on the Huck Fire and holding the Emerald Fire. Plans were to remove the Atlantic spike camp and move one strike team to the south side on the Mink Fire near Enos Lake to secure two flareups near the line and then to Emerald spike camp at the end of shift. The plan was to move the other two strike teams to Mink Base, one for structure protection on the Huck Fire and one to the Hunter Fire, leaving the Mink Fire unmanned.

The Mink Fire was unmanned on August 22 except for two helitack crews left to protect the cabin at Hawks Rest. The fire was active in the Thorofare and burned above Hawks Rest cabin, but the cabin remained intact. Burning was hot in the bottom of the Thorofare drainage setting up for a run up the canyon.

The fire remained without ground personnel on August 23, but daily reconnaissance was planned. Two helitack crews were dispatched to the Mink Fire on August 24 to work on spots. They remained overnight. The fire was burning hot in sections of Mountain Creek and the Thorofare working its way to the East. Lynx Creek had burned approximately half way up the drainage.

The fire continued to burn up the Thorofare and Yellow Creek on August 25. It was not expected to get over the rim of the Thorofare due to a lack of fuels. At 1310, the helitack crew at the Wyoming Game and Fish cabin were threatened by the fire. The crew moved into a wet meadow and deployed their fire shelters. Before deploying shelters, the crew wet themselves

with water, a violation of shelter deployment procedures. The crew escaped injury in the incident.

The situation on the Mink Fire was reassessed. The decision was made to reactivate control measures. Twenty-five crews were ordered and expected by Monday, August 29. The strategy was to contain the fire in the thorofare.

Plans to initiate control action were put on hold August 26 because of higher priority fires. Two Helitack crews remained at Hawks Rest cabin to protect the cabin and work hot spots on the fire.

The fire continued to torch and spot, working eastward up the Thorofare and down the Yellowstone River drainages on August 27. The strategy was to monitor; a crew was available to control critical areas if needed. A strong inversion limited visibility in most areas to near zero. The fire was 81,267 acres.

At 0930, August 28, the plan was to reactivate the spike camp at Yellowstone Meadow by Thursday, Sept. 1. A helispot crew remained to work around Hawks Rest cabin. The inversion remained limiting visibility and reducing the rate of spread.

The Mink and Red-Shoshone Fires merged at Badger creek on August 29. A helispot crew was committed to secure Hawks Rest cabin. Eagle Pass was not threatened.

A cold front with strong southwest winds occurred at midday, August 30. The fire continued to spread eastward up Pass, North Fork Butte and Thorofare Creeks. Two crews remained on the fire to work hotspots and secure portions of the perimeter where effective work could be done.

High fire danger continued with strong winds on August 31. The fire remained active on the eastern fronts. Two crews protected Fox Park patrol cabin on the National Forest. Fire size was 115,900 acres.

Fire activity dropped between September 1 and 4 due to an inversion. A strike team was flown in to work in the upper Yellowstone River drainage on September 1. The strategy was to cut off fire from moving up the Yellowstone River. The objective during this period was to keep the fire from burning onto the Shoshone National Forest. Crews continued to work the critical areas. Isolated torching and spotting continued with slow spread up the side drainages and the Yellowstone River. The fire size was 123,300 acres.

The most active fire was in the Pass and Silvertip Creeks area, between September 5 and September 9, where the fire was approximately 3 miles from Ishawooa Pass. The strategy was to continue monitoring and keep two handcrews working the perimeter in the Yellowstone drainage. The objective remained the same, prevent the fire from crossing onto the Shoshone National Forest. The plan was to tie the east flank of the Huck Fire into the west flank of the Mink Fire.

Gallego's team took over command of the 128,400 acre Mink Fire on September 9 at 1200, and the Huck and Mink Fires were managed as one incident as of September 11. mop up and line building progressed on the Huck Fire through September 15 when 100 percent containment was reached as line on the south flank was tied into the Mink Fire. Greenhoe's Type II team took over command of the Complex at 0900, September 16. Several inches of snow fell over most the burn on September 18. The Type II Team officially turned the fire over to the Bridger-Teton National Forest at 0800 on September 21. The Huck/Mink Complex was 100 percent contained and had burned 225,000 acres.

EMERALD FIRE

The Emerald Fire started by lightning near Emerald Lake on the Bridger-Teton National Forest, August 16, 1988, and was declared a wildfire. Six district people, 2 helitack crews and 12 smokejumpers initial-attacked the fire. Dale Jarrell's Type I Team agreed to support George Jackson on the fire from the Mink Base Camp. The extreme fire situation locally and regionally was considered, and a containment strategy was selected at 1000 on August 17. Consideration of potential loss of outfitter revenue, possible disruption to fall hunters, and air quality impacts to the Jackson Hole and Cody areas were addressed. Fire size was 130 acres. The main objectives were to protect improvements north of the fire, keeping it out of Falcon Creek, to keep fire from spreading into Yellowstone National Park, and to gain control of the fire with minimum acres burned, using natural fire barriers and light hand on the land tactics.

Jarrell's Team officially took command of the Emerald and Mink Fires at 0630, August 19. On that day the Emerald Fire became active and retardant was not available. Four crews were briefed and flown into the fire, with Filmore and Gall as Division Supervisors. The fire size was estimated at 875 acres. Fifteen crews, 1 helicopter, and 93 overhead brought the total personnel to 393.

Pushed by winds on August 20, the fire was across Mink Creek and grew to 1,200 acres. Control efforts were totally supported by aircraft with helicopters essential for all tactical and logistical support.

Priorities from Mink Base, August 21, were to protect structures on the Huck Fire and hold the Emerald Fire. Progress was made on the Emerald Fire. The previous day's wind resulted in many spots out in front. Water drops and retardant proved effective. The fire size was 1,475 acres.

Heavy smoke from the Huck Fire covered the Emerald Fire, August 22, holding down fire behavior. One hot spot on the east end was held using bucket drops. Handline and wetline were held on August 23, with no significant fire behavior reported. Two new crews were flown into the spike camp and replaced two crews released the previous day because of internal problems.

Control efforts continued with hand crews and bucket drops on August 24. Thirteen crews worked out of Emerald spike camp with a total of 16 crews assigned to the fire. One engine, 4 helicopters, and 140 overhead brought total personnel to 426. The cost to date was \$978,712.

August 26 and 27 were days of mop up action by crews supported with bucket drops. On August 28, the Emerald Fire was declared controlled. Three crews remained and the Emerald spike camp was removed as helicopter scheduling permitted on August 29. The total cost was \$1,649,924. Areas burned totaled 1,520 acres. The Emerald Fire was burned over by the Huck Fire on September 10.

HUCK FIRE

A tree across a powerline started the Huck Fire on August 20, on the J.D. Rockefeller, Jr., Parkway, administered by Grand Teton National Park. It was classified as a wildfire. The fire made an immediate run that threatened Flagg Ranch, requiring evacuation. Additionally Highway 89/287 was closed and Lizard Creek Campground was evacuated. The fire crossed the highway and burned onto the Bridger-Teton National Forest. At 1700, Doyle Nelson of Grand Teton National Park requested that Dale Jarrell's Type I Team on the Mink Fire take command of the Huck Fire. They agreed.

Driven by southwest winds up to 30 miles per hour, the fire had gone to 4,000 acres in 2 hours through dense lodgepole pine and heavy dead and down fuels. Direction of spread was into the wilderness and toward the southern boundary of Yellowstone National Park. The strategy was to control the fire west of the highway, protect structures, and provide safety for the highway.

Jarrell's Team sent overhead, scouts, and one Type I strike team to secure the 150 structures at Flagg Ranch. No structural engines were available, but a good water source was located at the ranch. Ten strike teams of firefighters, 3 strike teams of Type II or Type III engines, 4 Division Supervisors, 1 air attack, 1 air support helicopter, 2 light and 3 heavy helicopters plus logistics support were ordered.

An EFSA was completed, the selected alternative was contain/control by direct attack with protection of facilities and structures in the parkway as the highest priority. Huckleberry Lookout, on the National Register of Historic Places, was the second priority for protection. The potential for additional smoke in an area already suffering from extended smoke problems was addressed. The Teton Wilderness Fire Management Plan called for "total suppression" given the number and size of fires already burning.

The fire burned east into the wilderness, August 21. Three crews, 1 engine, and 3 overhead totaling 126 people were on the incident. The fire increased to approximately 5,000 acres by 1800. Line construction began on the west side of the fire (west of Highway 89/287) and the north and south sides of the fire beginning at the highway.

The fire continued to burn northeast and east into the wilderness August 22, and toward the south boundary of Yellowstone National Park on August 23. The northeast line was within 1/2 mile of Flagg Ranch and it held. Fire burned to the east over Huckleberry Ridge and to the south toward Steamboat Mountain. The Lookout was protected by water drops and it remained intact.

Highway 89/287 remained closed to public traffic indefinitely from Leeks Marina north. The base camp was located at the Snake River Campground, with the ICP at Black Rock Ranger Station. Twenty-one crews, 6 engines, 3 helicopters, and 61 overhead, for a total of 521 personnel were on the fire. The increase in acreage was approximately 6,000 acres on August 23, for a total of 12,000 acres burned.

Poor visibility due to heavy smoke made control difficult on August 24 and posed additional safety concerns. The fire moved eastward and 2 heads had formed. At 1800, the fire was 15,569 acres. Easterly spread continued toward Colter Creek August 25. Some backing occurred on the north side and the west side was completely lined. Flanking action continued and line was constructed into Arizona Creek on the south. The two heads on the east had burned together to form a solid front. Fire size was estimated at 21,500 acres.

A total of 15 engines were on the incident, August 26, many of which worked the highway to wet down burning material. The National Park Service wished to open the highway during the midday throughout the Labor Day weekend. A spike camp at Bailey Meadows was built. During the day, northwest winds increased driving the fire south and east. By 1200, the fire was active from Arizona Creek to upper Pilgrim Creek. Erratic fire behavior occurred, with spotting up to 3/4 of a mile. At approximately 2100, 5 crews totaling 120 people at the spike camp evacuated on foot to the south, down Arizona Creek. Personal gear was left in the camp, but was not damaged. The fire was an estimated 30,000 acres.

A strong inversion decreased fire activity on August 27 and 28 and mop up of the south and west lines continued. Bailey Meadows spike camp was reestablished and plans for a new spike camp on Pilgrim Creek were made. Additional crews from the Hunter Fire were to work on line from Pilgrim Creek to Arizona Creek and from Pilgrim Creek up Wildcat Ridge.

Line construction continued with an addition of 8 crews on August 29. A cold front passage, with southwest winds to 25 miles per hour produced extreme fire behavior and long-range spotting. The fire made a major run across Colter Creek near the saddle at the head of Pilgrim Creek for a distance of approximately 5 miles. Another hot area at the northeast corner of the fire ran northeast into Yellowstone National Park and across the Snake River. The fire increased by approximately 10,200 acres for a total of 42,300 acres. No established line was lost. The 33 crews, 15 engines, 4 helicopters (including 2 Chinooks), and 154 overhead brought the total personnel to 1,075.

Extreme fire behavior continued on August 31 and the fire made another run to the east. Some 200 army firefighters were on the line in a quiet division, mopping up.

An inversion decreased fire activity between September 1 and mid-day September 5. During this period, mop up and line construction continued and a new spike camp was built at Gravel Creek. The Army and several other crews were called to higher priority fires. A new EFSA was approved September 2, to include as a new priority, the prevention of fire spread to the south, where there are several developments at Colter Bay, Jackson Lake Lodge, and a residential area in Buffalo Valley. The EFSA provided for indirect attack in addition to direct attack due to; a lack of resources to support direct attack, the long duration of the fire causing firefighter fatigue, and the resulting loss of productivity limiting the effectiveness of direct attack.

By mid-day September 5, the inversion had lifted and the fire became very active. West-northwest winds up to 10 miles per hour created a 1/4 to 1/2 mile fire front on the ridge west of Gravel Creek. Fire spotted over the creek to the east and a rapid uphill run toward Gravel Peak also occurred. Direction of spread was southeasterly and camp personnel and crews on Division F were evacuated safely, but camp and personal gear were left behind.

Increased winds from a cold front on September 6 produced extreme fire behavior. The fire burned over Pinyon Point and across Gravel Creek. The strategy remained to prevent southerly spread of the fire toward private developments along Buffalo Creek. Twenty-four crews, 6 engines, 5 helicopters, and 175 overhead were committed to the fire, for a total of 640 people.

Strong southwest winds on September 7 resulted in continued extreme fire behavior along openings and flanks. A major burnout operation was successfully executed between Gravel and Whetstone Creeks in support of the strategy to keep fire north of Pacific Creek. The fire generated winds up to 30 miles per hour.

Fireline construction continued under an inversion, September 9, in order to tie the south side of the Huck Fire into the blackened southwestern side of the Mink Fire. The Red-Shoshone Fire in the Snake Complex and the Huck Fire merged in the north. Afternoon southwest winds caused spotting over the line. One spot was greater than 100 acres and was not contained at the end of the day. A Structural Protection Plan was written for the Buffalo River Valley in the event that the fire could not be contained in the vicinity of Pacific Creek. A transition to Steve Gallegos' Type I Team began. Thirty-four crews, 2 engines, 8 helicopters, and 239 overhead brought the total personnel to 798. Fire size was estimated at 88,300 acres; total cost was \$5,000,000.

The Emerald Fire was burned over by the Huck Fire on September 10. A cooling period began with light rain on September 10, and snow from September 11 through September 15. Good progress was made on mop up and

line construction during this time. As of September 12, the Huck and Mink Fires were managed as one incident. Total acreage was estimated at 225,500. On September 15, line on the south flank of the Huck Fire was tied into the west flank of the Mink Fire, and 100 percent containment was achieved.

Greenhoe's Type II Team took command of the incident at 0900 on September 16. Four Wyoming National Guard crews arrived and two Canadian helitack crews were assigned to the incident. Pacific spike camp and equipment on the line were removed on September 17, and line rehabilitation began.

One to three inches of snow fell on September 18, cancelling operations for the day. September 19 was the last full day on the line for rehabilitation and a major demobilization effort began. Eight crews, 6 helicopters, and 53 overhead for a total of 269 personnel were on the incident. The combined acreage for the Huck/Mink Complex remained at 225,500 acres.

Massive demobilization continued September 20 and total cost for the Huck Incident was 6,658,700. Ten to 15 AD firefighters and 1 helicopter remained on the district to finish line rehabilitation. The fire was officially turned over to the forest at 0800, September 21, and was 100 percent contained at that time.

NORTH FORK AND WOLF LAKE FIRES

The North Fork and Wolf Lake Fires were initially one fire. The North Fork Fire was administratively split on August 25 when the area became too large to effectively manage as one fire. Smoke from the North Fork Fire was spotted July 22 at 1420 hours by a Forest Service employee. It was a person-caused (woodcutter) fire which originated near the Park boundary on the Targhee National Forest approximately 15 miles south of West Yellowstone.

The North Fork fire covered elevations ranging from about 7000 feet to 10,000 feet and created a mosaic burn over 269,400 acres. This fire stretched about 50 miles. The boundaries were Moose Creek (Targhee NF) on the southwest, Madison Plateau on the south, and Kepler Cascades by Old Faithful on the southeast. The eastern boundary was Madison Junction and Gibbon Hill, and a separate finger pushed by winds ran from Old Faithful northeast to Mary Mountain. To the north, it bumped into Fan fire and burned over to Mt. Holmes. The western edge was the Park boundary along Madison Valley. It was declared 50 percent contained on September 26.

The Wolf Lake fire occurred on elevations from about 7,000 feet to 10,000 feet and resulted in a mosaic burn that covered about 75,000 acres. The boundaries were Canyon village and Tower Junction to the east, Mammoth and Lamar Valley to the north, and Mary Mountain to the south. The west and southwest boundary was roughly the line in Canyon Creek across Gibbon Falls then to the west flank, an administrative boundary which split Wolf Lake

from the North Fork fire. The fire was declared 50 percent contained on September 26.

The fire burned over rolling plateaus with all aspects represented. Slopes varied from level meadows to cliffs of short elevation. The vegetation was mainly forest dominated by lodgepole pine and associated herbs, grasses, and shrubs. Several lowland meadows were within the fire perimeter but very little of this vegetation type burned. Also included was small areas of Englemann spruce, Douglas fir, and subalpine forests. In the northern part, large expanses of sagebrush steppe burned.

Fire Chronology and Management Actions

The first observations of the North Fork Fire on July 22 placed the fire size at 75 acres. The fire started in grass and quickly spread into blowdown lodgepole and bark beetle-killed stands. By the end of the first burning period, acreage was estimated at 340 acres and National Park land had been involved. Dry, windy conditions contributed to rapid spread and spotting. Weather records show 10 mile southwest winds, maximum temperature 72 degrees and 25 percent relative humidity. Initial attack was started immediately after the fire was reported. The first request for support was two airtankers, four large dozers, five crews, and smokejumpers. Three Type 4 engines and six firefighters were immediately available. Smokejumpers were unable to jump on the fire due to high winds.

Incident Command was set up by local forces on the Targhee National Forest and orders for a Type I team were placed. The initial IC was Rodd Richardson. The EFSA Completed by Richardson's team on July 22/23 called for a control strategy on both National Forest and National Park lands. This would include burnout and direct attack involving dozers on national forest land and hand crews in Yellowstone National Park. Factors supporting this alternative included extreme fire behavior, high resource values in Targhee National Forest tree plantation, numerous other fires in the area causing heavy smoke loading, and heavy demand on suppression resources.

On July 23 a Type I Team with Larry Caplinger as IC assumed control of the fire at 1800 hours. An agreement was established between Targhee National Forest and Yellowstone National Park for cooperation on this incident. Acreage had grown to 1,300 as the fire moved further into Yellowstone National Park driven by southwest winds. This Team, in cooperation with Park representatives, developed an alternative strategy which was implemented at 2400 hours July 23. This strategy was to suppress the fire on National Forest land and to manage it on National Park land in accordance with the prescribed natural fire plan with confine/contain strategy. This involved construction of fire line on National Forest land and daily helicopter reconnaissance of the fire on National Park land. The rational for selection of this alternative was that it minimized risk to firefighters, minimized daily cost, protected national forest timber land and met National Park Service management objectives.

The fire grew to 2500 acres on July 24 and had moved about 6 miles towards Old Faithful since the first day. The overall strategy remained the same. The additional structural protection for Old Faithful. The ICP was moved from Island Park to Old Faithful the night of July 24. Another EFSA completed on July 25 prioritized protection of structures and actions which would direct fires away from structures in order to protect Old Faithful Village. A large order of engines and other resources was placed by Area Command, and plans were made to stop the advance of the southeast flank of the fire and to protect Old Faithful Village, should it become threatened. Fire size increased to 3,100 acres.

Protective measures were completed in the Old Faithful area on July 26, primarily in the form of fuel reduction. The IC Team prepared a backfiring plan to stop eastward movement of the fire by backfiring along the east side of the main fire. Acreage extended to 8,400.

Secretary of Interior Hodel was briefed at Area Command on the North Fork Fire July 27. The fire was within 6 miles of the Old Faithful Village perimeter, and burnout operations began on the fires' south and east sides. Estimated size was 8,500 acres.

Cooling temperatures and precipitation on July 28 slowed the fire's rate of spread. The previous EFSA (July 25) was modified to call for containment suppression strategy because of the numerous major fires within the Park. Containment would be accomplished by using natural barriers wherever possible and tying these barriers together with firelines or burn-outs causing minimum impact on resources. Indirect attack and backfiring continued on its south and east sides.

No measurable increase in fire size occurred July 29. Cooler conditions allowed for direct attack which began to bring the fire under control. The fire became more active by July 30. Winds associated with thunderstorms increased spotting over the fire line, and acreage was estimated at 11,300. Burnout operations along the south and east sides continued while line was constructed in one division of the northwest side.

On July 31, fire activity increased on all sides of the fire. Efforts were directed at holding the south and east flanks, while the fire was in confinement strategy to the north. Retardant was ordered to assist in holding the line. The July 28 EFSA was further modified in order to provide adequate safety for crews. Fire line could be widened to 4-6 feet where necessary to provide for crew safety. Acreage reached 16,800.

During the last week of July, Area Command called in a national team of fire behavior experts to predict fire spread and behavior. On August 1 at a meeting at Area Command, they presented the prediction that the North Fork fire would primarily spread east and northeast based on past, current and expected weather and fuels. Consequently, the EFSA was modified again on August 2, wherein it was decided that the cost of control for all perimeters was too expensive (\$4 million), and impossible with the limited resources, and without large-scale air support. The alternative selected was to contain the fire on the south and east to manage it on a confine/contain

basis on the north and west, and to monitor it daily. Structural protection would prevail at Old Faithful. This alternative cost \$2 million.

The fire burned hot again on August 1, but the south and east flanks were held while the fire advanced to the north. Handline crews were assisted by retardant drops until airtankers were shut down due to gusty winds. On August 2, strong winds drove the fire between Little Firehole Meadow and Buffalo Meadow. Retardant drops were planned to quiet the northern front. The fire continued to put up a column of smoke late into the evening. Acreage was 18,700.

Confinement boundaries for the fire were to include the Firehole River, which combines with the Gibbon River to become the Madison River on the north, and the Park boundary on the west. Targhee National Forest land was to be protected by meeting the fire at the Park boundary if necessary. Line construction and firing out continued August 3 on the south and east sides. Acreage was 18,700.

Overnight precipitation cooled the fire by August 4. The south and east sides were held by hand crews and aircraft, while the north and west sides continued to spread. Demobilization of some crews and overhead began. Fire size was estimated at 20,400 acres.

On August 5, a blowdown area about 2 1/2 miles north of Buffalo Meadow was ignited in an attempt to create a fire break before the blowdown and draw the split headfire into one leading edge. The burnout site was south of and adjacent to the blowdown, which resulted from a tornado about two years ago. It was three miles long and about a half mile wide. Winds were southwest at 5 miles, temperature 82 degrees and relative humidity 12 percent at 1900 hours. Transition from the Type I overhead team to a Type II team began. The new IC was Steve Raddatz. Two new protection areas were added to the incident: Madison Junction and West Yellowstone. Thunderstorms moved in during the afternoon of August 6, with winds gusting to 60 miles. By August 7 winds had carried the burnout through the blowdown area and east into Sentinel Creek and north across the Madison Plateau towards Madison Junction. The west end of the blowdown burned continuously. The fire was predicted to work west against the wind for an estimated 1/2 mile to the ridge top, then the flanking fire would widen as the front was caught by the prevailing wind and moved north towards the Madison River. Acreage reached 21,000.

During August 6-10 the fire remained within containment objectives. Line construction and burnout continued along the east flank. A 20-acre patch of blowdown burned on August 8, with minor spotting into Sentinel Creek. All fire fronts were active August 10. The fire did not cross the Firehole River, but all personnel were pulled off Division B when the fire moved out of Sentinel Creek. The fire made major runs August 11 on the north and east flanks. Fire crossed the road by Firehole River near Fountain Flats thus it was closed to public traffic. The blowdown burnout fire became the headfire. The original North Fork Fire did not meet the burnout on the east or south flanks but may have on the southwest flank. The Type I Team led by Dave Poncin arrived to begin transition to relieve

the Raddatz Team. Acreage was 34,120. Total personnel was 645 people, with 6 helicopters, 2 airtankers, and 2 fixed-wing aircraft.

Rain showers all day on August 12 reduced fire activity through August 13. Line along the east flank of the fire was tied into the Old Faithful road. Line was also completed from Lower Geyser Basin south to the point of origin of the fire, then north to the Montana State line. The southwest side of the fire was lined to protect Targhee National Forest plantations and Black Canyon Research Natural Area. All known spot fires resulting from the blow-up of August 10 were lined and mopped up. Total acres were 52,960.

Fire activity increased again August 15-18 with higher temperatures (mid-80's) lower humidities (7-18 percent) and winds (southwest at 5 to 40 miles). Suppression efforts were directed toward structure protection at Madison Junction, protection of Black Canyon Research Natural Area, and improvement of existing line. On August 17, the fire made a major run to the northeast up the Gibbon River Valley. The facilities at Norris were being evacuated as engines were positioned at Norris, and an irrigation system was repositioned to protect a power substation and main park powerlines. Line continues to be constructed and held along the southeast flank. With winds 10 to 12 miles major spotting across fire lines occurred, but all constructed lines held. Acreage was reported at 69,000+ by August 18.

High winds (20 to 30 miles, with gusts to 40) hit the fire August 20. Crews managed to hold constructed line on south and east flanks. Spotting occurred on the southwest flank outside the fireline, and crews worked to contain it. The head of the fire continued to advance to the northeast, crossing the road between Norris and Canyon Village. All structures and improvements at Norris were protected.

Lower winds (10 to 20 miles) and temperatures (high 70's) as well as slightly higher humidities (15 percent) reduced burning activity on August 21, although the head of the fire remained active, spreading northeast toward the Yellowstone/Madison divide. The weather was favorable for picking up spots along the flanks after the major run of August 20. Total acreage was at 91,700.

The fire continued to move on active fronts driven by moderate winds and low humidities August 22-24. The fire again threatened the facilities at Norris junction, and protection efforts were supported by the redirection of two engine strike teams. Construction of secondary line along the west boundary of the Park was completed August 23. The fire continued to move eastward toward Canyon Village after a major run. Crews worked through the night burning out along the Norris/Canyon road in an attempt to keep the fire north of the road August 24. Fuel modification and structural protection efforts continued in Canyon, and fuel modification was begun at West Yellowstone. Acreage reached 104,300. Total personnel was 1,176 people and 9 helicopters.

Major runs to the north and northeast occurred August 25, along with reburning of green islands in the south end. High temperatures (high 80's), gusty winds (8 to 15 miles) and low humidities (14 percent) continued to hamper suppression efforts. Crews worked to line a slopover along the south end of the fire, as well as a spot south of the Norris/Canyon road two miles west of Canyon. Structure protection at Norris and Canyon and fuel modification at West Yellowstone continued. Two blasting teams used fireline explosives to construct line southwest from Sevenmile Bridge toward the Park boundary Aug. 25-26. Estimated cost was \$9,214.00.

On August 25, the North Fork Fire was split into two fires because the length and size of the wildfire was too large to be efficiently managed by one team. Curt Bates' Type I team arrived to take over the northeast portion of the fire, to be called the Wolf Lake Fire. Its boundaries reached from the Gibbon Falls area east toward Canyon Village. Poncin's team remained with the North Fork Fire. This split allotted the North Fork Fire 77,800 acres and the Wolf Lake 30,276 acres.

North Fork Fire

Crews worked throughout August 26 trying to line a slopover in the south end of the fire that posed a threat to Old Faithful. Burnout operations began along the west boundary of the Park. The blasting crew continued line construction between the Park boundary and Sevenmile Bridge. On August 27, a Canadian cold front brought north winds (15 to 20 miles), which spread the slopovers to the south and southeast, posing continued threats to Old Faithful and to the Moose Creek Resource Natural Area on the Targhee National Forest. A heavy smoke inversion delayed access to the remote Targhee slopover, but dozers helped construct line which was expected to hold through the burning period. Fuel modification continued in West Yellowstone to reinforce secondary control lines as the fire continued its westward spread. Reported acreage was 85,400. Total personnel was 759, with 7 helicopters. Included were four Type I crews and 14 Type II crews.

During the night of August 27-28, the fire moved into the Moose Creek Resource Natural Area, and dozers were used to construct line within the natural area on the 28th. Retardant drops and helicopter bucket operations helped control spotting and supported line building operations along the southern and southwestern fire boundaries. Smoke inversions hampered aerial activities. Two Army units arrived for training. Lighter winds allowed some progress on the southeast and southwest flanks in spite of brisk fire behavior. There was little movement towards Old Faithful but the threat continued. Fuels modification continued at West Yellowstone.

The fire continued to be very active on the southwest portion on August 29. Air operations were again restricted by a morning inversion. Crews worked to contain the fire along the west Park boundary with Targhee National Forest and along the southern edge. Seven strike teams of Army crews were on the firelines in continuation of their training. Area was up to 90,1000 acres. Total personnel was raised to 1,090 people.

The fire made major runs north of the Madison River and east of Summit Lake in the southeastern portion of the fire on August 30. Old Faithful facilities were expected to be threatened in the following two days if present burning conditions prevail. Strong southwest winds were causing spotting of up to two miles ahead of the main fire. The road from West Yellowstone to Madison Junction was closed for three hours. Additional engine strike teams were positioned at Old Faithful and West Yellowstone. Four companies of the U.S. Army were on the fireline doing line reinforcement. Active fire behavior during the last couple of days resulted in spotting and slopovers in places on the existing fireline.

Denny Bungarz's Type I Team assumed control of the fire, relieving Poncin's team on August 31. Despite calmer winds, the fire remained active consolidating the runs of the previous day. Engine strike teams were staged to protect West Yellowstone and Old Faithful, and dozers were used inside the Park to reduce the danger to West Yellowstone. The fireline blasting crew continued to produce effective line that held. Acreage was 109,100.

On September 1, a heavy inversion restricted most air operations and the fire remained relatively calm throughout the day. Suppression efforts were concentrated on Division B, Q, and F to reduce the threat to West Yellowstone and Old Faithful. Evening drainage winds on the southwest side of the fire, however, resulted in a blowup condition, with the fire approaching to within 1-1/2 miles of West Yellowstone. Burnout operations were done September 2 north and east of the Madison River to reduce the risk resulting from similar weather forecasts for the following two days. The fire front southwest of West Yellowstone blew up in the afternoon and was moving south, away from town. Acres were reported at 117,400. Total personnel was 1,263, with 7 helicopters and 7 watertenders.

On the night of September 2-3, the fire driven by northerly winds moved beyond the Park's west boundary onto the Targhee and Gallatin National Forests, and housing developments east of Island Park were threatened. A sprinkler system was installed east and south of West Yellowstone. Suppression priorities were West Yellowstone, residential areas west of Island Park, and Old Faithful using engines, handcrews, and dozers. Resources on loan from other complexes included 1 Type I engine (Clover-Mist), 8 Type 2 engines (Red Shoshone and Mammoth, and 4 1,500-gallon foam engines (Mammoth).

September 4 suppression efforts focused on the west flanks on the Targhee and Gallatin Forests, with engines, handcrews, and dozers. A heavy inversion lasting all day hampered aerial support and reconnaissance efforts. The fire continued to move slowly to the northwest. mop up and patrol continued southeast of West Yellowstone along the dozer line. Hazard reduction was initiated again at Old Faithful. The southeast flank was without crews because resources were committed to structure protection. September 5 was a busy day due to slopovers, light to moderate fire activity, and two injuries that required aerial medivacs. Seven handcrews were received from the Huck Fire, and demobilization of remaining crews was delayed 48 hours due to a predicted major wind event for the following two days. Humidities dropped from 28 percent to 8 percent in two hours on the

north portion of the fire, causing some extreme fire behavior. Divisions A and I finished dozerline construction and mopped up and held completed line. Division G continued burnout at headfire along Madison River. Division J constructed dozerline to the Park boundary, and lined and mopped all spots. Air tankers were called in to assist slopovers. Two injuries required air medivacs. Fire activity was noted south and east of H-21, and numerous large spotfires east of H-20 in direction of Old Faithful. Acreage was 141,900. Total personnel was 1,368; 6 helicopters and 11 water tenders were in support.

By September 6, the fire was three miles from the Old Faithful Complex. Hazard reduction was being completed, and a sprinkler system was installed along the powerline behind the residence area. The wind condition increased to 15 to 20 miles per hour with gusts to 30, creating significant runs to the northwest deeper into the Park. Air tankers dropped retardant and Vertol helicopters dropped water on spotfires by Thirsty Creek. More sprinkler systems were installed for residences at the Duck Creek Area and Old Faithful. Total personnel was 1,608 (22 crews), with 13 water tenders and 6 helicopters.

On September 7, the fire advanced on all fire fronts, driven by winds up to 50 miles per hour. The first major activity was a run to the northeast across the road between Norris and Mammoth which closed the road and continued to spread rapidly to the north. The fire made a run at the Old Faithful complex and hit the area at 1540 hours. An evacuation plan had been prepared July 28, and had been partially implemented before Old Faithful Village was overrun. Despite extreme fire behavior, high winds and thick smoke hampering suppression efforts, the only structures lost out of 400 structures in the Old Faithful complex were 19 cabins, 2 dorm rooms, 3 storage/shop buildings, 1 restroom, 5 vehicles, 1 water tank, and a television transmitter station. No injuries to operations, personnel, or the public occurred. The fire spread around the complex, spotting up to at least 1/4 mile, and crossed the main road to join on the northeast side. Estimated cost was \$15,492,743.

The North Fork Fire increased by 56,000 acres September 7, most of this gain occurring to the north and around Old Faithful. Only division B held, so new firelines had to be constructed and parts of old lines improved and mopped up. This brought the total acreage to 221,800. Some evidence of the extreme fire behavior could be seen in the Obsidian Canyon area where approximately two acres of lodgepole were broken off at the 30-foot level, apparently by cyclonic winds generated by the fire. The understory did not burn.

Strong winds up to 25 miles per hour escalated fire activity so efforts on September 8 focused on mop up of the Old Faithful area and prevention of any further spotting or flare-ups near improvements. Dozer and handline construction continued to the north along the western Park boundary and along the fire's western edge to attempt to keep the fire from spreading further west toward Duck Creek where structures could be threatened. Line improvement and mop up continued on all divisions. Fire was reported to be

within 2 1/2 miles of Mammoth. There was coordination with Wolf Lake Fire to protect Lake Village.

High winds continued driving the fire north and northeast towards Yellowstone Lake, with the wind and the fire following major drainages, as had been the pattern for previous wind events. Calls were exchanged with the neighboring planning sections and efforts coordinated with the Wolf Fire for protection to Lake Village. mop up continued as hot spots around Old Faithful showed up. The protection of life and property in West Yellowstone, was continued. Dozer construction of line along the Park boundary north from Cougar Creek began on September 10, while handcrews supported the dozer work and constructed line from Cougar Creek south. Fire activity was extreme, with winds up to 70 miles per hour reported from near the Cougar Creek efforts. South and southwest winds were pushing the fire north, threatening the Duck Creek area. Total acreage was 263,400 with 1,464 personnel assigned. Two engines were sent to Mammoth and one handcrew to Lake for structure protection.

Snow fell on September 11, limiting the work of the handcrews, while dozers tied in fire edges. Emphasis was on locating fires west of Highway 191 north of West Yellowstone. Long-range perimeter defense was planned. The following days also proved to be good for strengthening lines and mop up as inclement weather continued. A strong effort was made to handline slop-overs on the west side of Highway 191. Projected acreage from a September 12 infrared flight was 319,000 acres, although aerial reconnaissance of the northeast and northwest perimeters was expected to increase this figure. Containment was estimated at 50 percent on September 15. As mop up and rehabilitation efforts continued, a transition was made from Bungarz's Team to to Russell's Type II Team on September 17. Additional assistance from the Marines had brought manning up to a peak of 2,194. Resources were 2 engines, 16 dozers, 5 helicopters, and 9 water-tenders. Confirmation of reconnaissance in the northeast area increased size to 400,100 acres.

Three days of moderate weather with higher humidities kept perimeter enlargement minimal. There was an increase in flu, bronchitis, and strep throat among personnel. Clearing weather started to dry the fine fuels by September 21, and by September 24, many of the fuel timelag classes had returned to their summer lows and relative humidity decreased to near 20 percent, with potential for the fire to run. On September 25, the acreage remained at 410,000, with 50 percent containment. Most resources have been demobed, with the exception of 3 helicopters, 11 crews, and 2 water-tenders. Expected containment date is October 17, with estimated control by November 13. Cost to date is \$22,395,500.

WOLF LAKE FIRE

On August 25, at 0600, the management of the northern-most portion of the North Fork Fire was transferred from Incident Commander Poncin to Incident Commander Curt Bates. The northern portion of the North Fork Fire was to be known as the Wolf Lake Fire. The division of the fires was defined as a line from the southern-held line in Canyon Creek northwest across the highway between Madison Junction and Norris Junction at Gibbon Falls, hence to the Purple Mountains and Secret Valley west to the western flank of the fire. Canyon Village was the location of the new ICP.

The specific directions were: 1) protection of life/property as primary; finance secondary, 2) all necessary hand and power tools may be used; "light on the land" tactics prevail; dozers may be used to protect life and property, but specific use must be approved by the line officer or his representative, 3) grizzly bear habitat exists in the area. Fire objectives were to keep fire south of Tower-Mammoth road, east of Norris-Mammoth road, and west of Canyon-Tower road. Primary protection was structures at Canyon and Norris. Control problems were heavy fuels, dry conditions, and poor access. The estimated acreage was 30,276. There was an extreme shortage of resources. No air support was available.

Canyon Village was still threatened on August 26. Gusty winds (10 to 20 miles per hour) and very dry conditions made control extremely difficult. Shortages of resources continued. Communications were poor because of the number of large fires in close proximity. The fire appeared headed for Yellowstone River. Costs were estimated at \$126,000. Total personnel was 518, with 4 engines. On August 28 the fire activity increased, threatening the power lines and substation at Canyon Village. Forecasted fire weather put Canyon Village in line of the headfire and extensive spotting was expected. Engines, crews, and air support were set for protection. Three hundred army troops arrived as reinforcements. ABC's 20/20 News team was on the fire doing a feature story on the Wyoming Hotshot crew. Acreage was 33,265 and cost estimated at \$585,660. Total personnel was 518, with 4 engines.

Canyon was still threatened on August 29 and 30 while burnout operations and protection of electric lines and substations continued. Snags were falling on highways. The fire made only slow progress to the northwest, but return of southwesterly winds renewed the threat to Tower. Strong southwest winds pushed the fire across lines south of Canyon. The fire jumped the Grand Loop Road, south of Canyon Junction yesterday and made a run in Alum and Otter Creeks. It also ran approximately 2 1/2 miles northeast and was feared might cross the Hayden Valley and join the Clover-Mist Fire. There was fire on Dunraven Peak, one mile from Mt. Washburn. Lack of air support (water drops) resulted in a major setback. Measures were being taken to protect a microwave tower and other facilities on Mt. Washburn. Canyon was still threatened. An evacuation plan was developed for Canyon Village and ICP. Fire crews witnessed a fight between a buffalo bull and a grizzly that ended in a draw. Total personnel was 645, with 5 engines and 5 watertenders.

August 31 was spent picking up lines lost the day before. Two miles of irrigation pipe was installed to protect the power lines. The NPS handled a grizzly bear threat near the fire camp at Canyon Village.

On September 1, the fire was estimated at 40,100 acres. Firelines around Canyon Village were still threatened. The fire had progressed into Carnelian Creek and burned to the west of Observation Peak, but had not entered the Grand Canyon. The army crew constructed 3 miles of line at Tower. Helicopters had to be parked in corrals overnight to protect them from bison. Pack strings were being utilized to carry equipment 6 miles into the fire. Estimated cost was \$1,230,270.

On September 2, all available resources were placed to secure the southeast line. Crews held the lines, supported by helicopters. Lines have been completed at Tower in the event the fire should reach that area. The predicted weather conditions and Grand Canyon "wind influences" started to pose a threat to the Lake Complex. Helicopters were used to head off the grizzly bears following the line crews in Hayden Valley.

The fire was 10 percent contained on September 3, with estimated acreage at 59,000. Strong canyon flows pushed fire to the south. Crews spiked out last night to complete burning, and crew depletion continued to be a problem. Overhead tried to make a determination of whose responsibility it was to protect structures at Lake Village - Wolf Lake or Clover-Mist? Estimated cost was \$1,583,710.

On September 4, there were 200 firefighters, most military, in spike camps to hold the southern flank against predicted strong winds. The lack of helicopters to ferry personnel limited suppression efforts. Burnout was completed on Division E and lines were holding. Wolf Lake Incident Commander will protect Lake Village. On September 5 the fire was 14 percent contained. Lines on the south were holding after great effort by the crews and bucket support. An attempt to hook the fire on the north was aborted when spotting could not be controlled. Strong, southwest winds and accompanying high fire behavior threatened Canyon, Tower, and Lake. Emergency contingency plans were being formulated for Canyon Village.

By September 6, the fire was pushed towards Canyon so evacuation plans were made. A night shift was planned, with safe sleeping areas assigned in camp. Activity around Lake Village increased so the burnout began at night east of Lake. Structural protection and fuels treatment at Tower continued with two more days needed for completion. Lines were holding. A battalion of infantry was committed to replace demobilized Type II crews. Lack of helicopters continued to be a problem since borrowed ships left the missions incomplete due to early returns. Total personnel was 691, with 3 helicopters, 10 engines, and 2 dozers.

On September 7, the fire burned to Canyon visitor center. Hard work by crews, engines, and great helicopter bucket work saved all structures. Yesterday's preparation paid off as plans were executed without confusion, despite high winds and dense smoke. Canyon's next threat will come from the north because the fire crossed the highway in a major run at Dunraven Pass.

Tower, Lake and Mammoth are all threatened. Lack of crews and lowered crew strengths on available crews hampers efforts. Estimated acres were 64,300 and estimated cost \$2,455,550.

There were no major runs on September 8 but fire continued to spread toward Tower and Lake, and on three sides of Canyon. Lowered crew strength and availability continued to be a problem. Sprinkler system at Roosevelt Lodge was in place and operating. Planning for defense of Lake continued. IR flights were needed to evaluate where North Fork Fire is located in order to plan defense of Lake and Tower. The estimated cost was \$2,677,830 and acreage 70,400 acres.

Winds,(10 to 15 miles per hour) and low humidity (15 percent) on September 9 increased fire activity around Canyon and Tower. Fire crossed the road between Tower and Mammoth approximately 8 miles east of Mammoth. The fire head that overran Old Faithful is headed toward Lake Village. Wolf Lake Fire has sent two strike teams of engines to Mammoth. The Wolf Lake Fire tied into the Clover-Mist Fire on the north flank. The acreage is estimated at 75,500. The peak day thus far with 761 personnel, 13 engines, 2 dozers, 3 helicopters, and 10 watertenders.

On the night of September 10, the fire made a hard run at Tower, but due to preparation, no structures were lost. Northwest winds threw the flank fire into a head fire and the fire turned back towards Lake where preparations continued with fuel modification and installation of sprinkler systems. Light rain covered most of the fire this day. By September 11, an accumulation of 3 inches of snow occurred at the higher elevations. mop up continued around Tower, and the fire was out in many places. Bates met with the Area Command and other ICs at Grant Village to discuss priorities and strategies. Due to completing objectives and snowfall, Wolf Lake demobilization was planned for Tuesday, September 13. Excess resource list will be given to Area Command. Estimated acreage is 87,500.

Sholly assumed IC after Bates on September 12. Relative humidity dropped to 14 percent, with winds at 10-15 miles per hour. The current threat was to Mammoth Headquarter's structures and escape to Gardiner and Jardine. Controls problems were spotting, erratic fire behavior, and high winds. Acreage was undetermined. Higher relative humidities on the September 13 reduced problems to scattered spots, but 4 additional crews were on order in addition to the 8 on the fire. Forty-seven engines were assigned. Winds were calm through September 14 and 15. Acreage on September 15 was listed as 194,560, which was noted as including most of Wolf Lake and some of the North Fork's acres.

On September 16, Wolf Lake acreage was estimated at 105,200 acres with no estimate of percentage contained and no estimated date of containment. The acreage was adjusted by Area Command's instructions. Thirty-eight engines and 27 crews were assigned, and 8 smokejumpers and 1 saw crew were resources needed. Predicted wind speeds were 15 to 25 miles per hour from the southwest. Fire on September 17 was very active by the afternoon, with high winds. Operations with Unified Area Command were ended on this date.

Additional acreage burned along the Yellowstone River and Little Quadrant Mountain. Through the burning period on September 18, totaling 107,460 acres. Forty-seven engines and 33 crews were assigned. A total of 1,468 firefighters were assigned by September 19, the peak number. Forces were reduced to 1,302 after September 20 as wet weather reduced the line to be built from 540 to 160 chains.

On September 21, an Escape Fire Analysis for the Mammoth/Wolf Lake portion of the North Fork Fire was prepared, outlining the suppression alternatives considered for the Wolf Lake Fire. Alternatives under four scenarios of weather conditions ranging from cool and damp to windy "Indian Summer" conditions were considered for four major areas of concern. The preferred strategy had a plan of attack and resource level aimed somewhere between the cool moist level and the Indian Summer level. Planned resources for the 5 days through September 26 were 17 crews, 10 helicopters, and 14 engines. September 27 through October 1, the fire was transferred to Yellowstone Park. Resources were 2 hand crews, 3 helicopters, and 2 engines.

On September 22, the fire was reported as 15 percent contained. Resources included 21 crews, 29 engines, totaling 1,181 personnel. Fire was somewhat more active on September 24, however: very few additional acres burned on the fire's edge. This continued on September 25 as burned acres remained unchanged despite high winds.

On September 26, 50 percent containment was achieved, with acreage involved placed at 107,500 acres. Total containment will depend on receiving significant precipitation. Some burning was noted on the Fire edge on Mt. Everts. Crews numbered 20, with 12 engines and 9 helicopters. Moderate rain fell on September 27, with low fire activity. Some 640 Marines were demobilized. Seventy-five percent containment was reported on September 29, with 107,500 acres involved. Cost to date is \$14,686,315, with mop up progressing on schedule.

HELLROARING FIRE

The Hellroaring Fire, starting August 15, was a human-caused ignition near an outfitter's camp on Beaver Creek, Gallatin National Forest. It was declared a wildfire. The final perimeter was Tower Junction to the south, Hellroaring Mountain and Silver Basin to the west, Crow Mountain to the north, and the Storm Creek Fire on the west at Lookout Mountain and Slough Creek. Elevations ranged from 7,100 to 10,000 feet. This wildfire grew to 81,950 acres by mid-September, when it was finally contained. Control will occur when winter snows extinguish it.

Vegetation types within the perimeter of Hellroaring include lodgepole pine, Douglas-fir, whitebark pine, and subalpine fir, meadow, and sagebrush steppe.

Fire Chronology and Management Actions

The fire was detected and reported by a Yellowstone National Park reconnaissance patrol at 1255 on August 15. Low humidity (11 percent) and gusty winds of 25 miles per hour caused rapid growth to the north and east, with spotting up to 1/4 mile. Sholley and Clary of the National Park Service attacked the fire and prevented its spread into a nearby outfitter's camp. Smokejumpers, diverted to the fire, were unable to jump due to high winds. Tanker drops began at 1322, and initial attack crews were ordered.

There was immediate concern for the public and the five occupied outfitters camps in the area. Action was taken to contact these people and move them out of the fire's path.

At 1454, retardant drops had to be stopped due to high-wind hazards. A reconnaissance estimated the fire at 80 to 100 acres in heavy timber with a strong south-to-southwest wind. The Gallatin crew arrived in Gardiner, but could not be flown into the fire because of high winds and late arrival. An Escaped Fire Situation Analysis was prepared and a Type II Team ordered.

By 1100 on August 16, initial attack crews began to reach the fire. Gusty winds continued to push the fire north and east with spotting. The fire burned 180 additional acres for 300 acres total. A second crew reached the fire on August 17. The remoteness of the wilderness site made it difficult to supply the camp with personnel and equipment. Extreme fire behavior was observed as fire continued to spread, with torching, crowning, and spotting 1/4 to 1/2 miles. Flame lengths were observed at 200 feet as the fire burned past the base camp as a sustained crown fire at 80 chains per hour for 1 hour. The fire totaled 500 acres. Wayne Long arrived as Type II Team IC. More forces arrived on August 18 as stronger winds channeled up Hellroaring Creek, causing the fire to spread north to northeast, with torching, crowning, and spotting up to 1/2 mile. A spot west of Hellroaring Creek was contained.

Active burning continued on August 19, with spotting verified at 3/4 mile. About 1200, a spot fire on the west side of Hellroaring Creek received quick containment action. A whirlwind was observed picking up large material at the head of a draw near the spot fire. A second spot, 1/4 mile to the north, was observed and crews headed for it, arriving in about 10 minutes. Within this time, the spot had grown to 1 acre and was burning in the tree crowns. Within 15 minutes, the spot had grown to 30 acres in size and was sustaining a crown fire moving up the west side of Hellroaring Creek at about 60 chains per hour with 60 foot flame lengths. By 1800, the spot had burned 3 miles to the north. A total of 8,000 acres was involved on this date. A red flag warning for high winds from thunderstorms was predicted for the following day.

Intense fire activity began early on August 20 as the inversion lifted and dark smoke columns were observed. By 1100, a major run was occurring in the Hellroaring drainage. Smoke was observed to be pulling in towards Hellroaring from all directions and the column was estimated to reach 27,000 feet mean sea level. Reconnaissance confirmed the fire had consumed the

entire headwaters of Hellroaring and the northwest half of the Middle Fork. The fire is estimated to have sustained a rate of spread of 80 chains per hour for 8 hours. The Bull Moose cabin was destroyed. Fourteen thousand additional acres increased the fire total to 22,000 acres amid winds estimated to be gusting to 60 mile per hour, with sustained winds of 25 to 30 miles per hour.

Light winds on August 20 reduced fire activity although occasional torching and crowning occurred in the afternoon in unburned areas of the Middle Fork and East Fork headwaters. Spots were also detected in Hummingbird Basin, 1 mile across the divide to the east.

Infrared mapping showed the fire size to be 26,448 acres August 22. Fire and wind direction was very unpredictable, for example, west winds hit Mt. Brundage, turned down Grizzly Creek, and resulted in a northwest wind on the fire near Brundage Creek, causing the west flank to advance to the west and southwest. Fireline explosives were used successfully along Hellroaring Creek. The southern flank of the fire was covered with hose and pumps. Retardant drops had to be cancelled due to winds and low visibility. Personnel numbered 437 as a Type I Team was ordered and a revised EFSA prepared on August 23. This day was fairly uneventful for fire behavior.

Dennis Bungarz assumed IC position, Type I Team, on August 24. Winds shifted from the passing of a front moving the fire out of Elk Creek towards the southeast, with 1/2 mile spotting, torching, and crowning. Winds continued from the north the next two days channeling down drainages to push the fire to the south. Heavy ground fuels created intense fire, unmanageable by hand crews. Total acreage was 30,000. The fire was within 1 mile of Yellowstone Park on August 26. A spot on the east side of Hellroaring Creek was contained with the help of air tankers. The retardant was effective, and it was felt the spot could not have been contained without it. On August 27, the fire made a run into the Park on the west side of Buffalo Fork. The fire continued to torch, crown, and spot. Handlines would not hold unless reinforced with water and mopped in at least 25 feet. Ninety acres in the Park were burned and the fire totaled 34,200 acres.

A high pressure system over the area on August 28 resulted in low relative humidity, but less winds. Burning continued within the perimeter, but no acreage increase on the perimeter. The fire was 60 percent contained. Fire behavior intensified on August 29, as stronger upcanyon winds pushed the fire across Cat Creek into Telephone Basin. Timber in Telephone Basin is very patchy, with scattered whitebark pine and some spruce. The fire jumped from tree to tree, leaving sparse ground fuels unburned. Reburning of the area west of Buffalo Fork and north of the Park boundary was intense with sustained crown fire. The smoke column was easily visible from Gardiner. Spot fires were detected, but crews were unable to secure them.

On August 30, W. Long became IC again. Containment was reduced to 50 percent, 300 acres within Yellowstone Park. Buffalo Creek cabin was threatened. Two crew members remained at the site overnight for cabin protection. During the intense afternoon burning period, crews on the southeast corner of the fire moved into preplanned safety zones and remained there for the rest of the day. Hellroaring and Storm Creek Fires were about 6 miles apart at a point 3 miles north of Yellowstone National Park. A dry Pacific cold front passed, with gusty winds to 30 mile per hour from the southwest to the northwest. A run on Grassy Creek had a rate of spread of 40 chains per hour, with sustained crown fire. The fire inside the Park backed at about 1 to 3 chains per hour, torching nearly all the trees as it advanced. Fire size was 39,200 acres.

August 31 continued with active burning. A large column was observed coming out of Buffalo Creek, which increased through the afternoon. Two personnel at Buffalo Fork cabin tried to burnout around the historic 1913 cabin, but could not get the burnout to carry and remained at the cabin rather than try to proceed down Buffalo Fork. The meadow at the cabin was an adequate safety zone, and the cabin, which had been previously covered with fire shelters and wet down, did not burn. The timber east of the cabin started to burn around 1500. Packers moving the spike camp out of the meadow near the Park boundary on Buffalo Fork were cut off to the south and had to spend the night in the area. A strong nighttime inversion resulted in a thermal belt condition with active burning at mid-slopes late into the night, spreading to the south, across the Montana-Wyoming State line. The fire increased 6,100 acres this day.

A major run was made into the Park at the fire's southeast corner on September 1. Intense burning in the old lodgepole stands forced crews to abandon fireline constructed over the past several days, northwest of Buffalo Butte. Three acres on the Buffalo Plateau to the south burned, but grassy areas on the plateau did not support fire spread. IC Long attempted to speed up line construction using a horse-drawn plow. Storm Creek Fire made a major push towards the south and the Silver Tip Ranch. Top priority was placed on protecting the ranch and property by Storm Creek Fire crews and engines. The only people left at the ranch were staff who had been trained to assist the firefighters.

The shift plan of September 2 states that due to present burning conditions of heavy fuels, rapid rates of spread, and explosive conditions, direct attack of Hellroaring had been unsuccessful and dangerous. Indirect attack was felt to provide the margin of success that would allow containment. Three separate areas in the south and west of the fire's main southeast leg showed significant new acreage. A heavy inversion layer blanketed Gardiner and two out of three helicopters were down for repairs. Crews reported seeing lots of deer, moose, and black bear. Old lodgepole stands continued intense burning. Infrared on September 3 estimated acreage at 53,900. Active lobes of the fire on the eastern and western flanks continued to push south. About 8,500 National Park Service acres had burned. The fire was estimated to be one to two miles north of Slough Creek campground. Spread to the north in upper Buffalo Creek had almost stopped. A dense inversion over Hellroaring held activity down on September 4. The

fire advanced west of the National Park Service Buffalo Plateau cabin. The cabin was effectively prepared by the National Park Service and was saved. Hellroaring was about 1-1/2 miles northwest from the Slough Creek campground and moving in a southwest direction. A Storm Creek firestorm was roaring down the drainage towards Slough Creek also. Buses were on standby throughout the night in case of needed evacuation. A firestorm burned around Silver Tip Ranch and precautionary deployment of fire shelters was ordered for the "civilian" camp personnel. All structures were saved at Silver Tip Ranch.

September 5 preparations for burnout operations were made. Winds gusting to 16 miles per hour and relative humidity of 11 percent caused the fire to spread in the grassy areas of Buffalo Plateau. Timbered areas had frequent torching. About 2,000 acres burned this day. On September 6, another deep inversion covered the fire until late in the day. Dense smoke shaded the fuels and reduced fire activity. The burnout was postponed.

On September 7 around 1300, winds from the west and southwest were favorable to the burnout and ignition in the interior of the planned burn area began by using a helitorch. Fires ignited easily and carried into the crowns rapidly. Very little difficulty occurred holding the control line. The burnout totaled 4,700 acres. Other areas held for a total of 62,170 acres. As the first phase of the backfiring was "picture perfect," the southern section was fired on September 8. Smoke from the fires to the south caused visibility problems so helicopter ignition could not start until about 1430. Darkness and rising relative humidity shut down the burning after 15,060 acres were ignited. Winds were expected which might drive North Fork or Wolf Lake into the west flank of Hellroaring where fire might threaten Jardine. Smoke from fires to the south prevented aerial ignition on the remainder of the burnout on September 9, and the remaining area of Slough Creek was ignited by hand. The North Fork and Wolf Creek finger of Hellroaring combined on the night of September 9 at the south end of Hellroaring, from the Grand Loop Highway to Specimen Ridge. The previous backfire was successful; however, this area was joined by aggressive spots to the North Fork Fire. Slough Creek spike camp was evacuated due to fire danger and the Beaver Creek spike camp was evacuated due to grizzly encounters. Containment for the fire was estimated for 1800 hours on September 11. Very strong south to southwest winds signaled the approach of another cold front, but the relative humidity remained in the high 40's on September 10. Fast spreading fuels would not burn on September 10, giving crews time to finish containment on the south side. An increase of 600 acres observed on the infrared photos was actually a finger of Wolf Lake Fire.

It started snowing lightly about 0730 on September 11. The fire was inactive, giving crews a chance to mop up in Grizzly Creek. The fire was officially contained at 1800. Acreage was placed at 81,290. Crews quickly took care of a spot the next day, south of the Coyote spike camp. Through September 13, the weather remained overcast with no fire activity. Updated acreage from infrared was estimated at 81,890 acres. Cost to date of containment was \$4,343,000. Wolf Lake Fire spotted across the Yellowstone Canyon onto the edge of the Hellroaring Fire, but containment lines held.

IC Long was replaced by Clay Gregory, Type II Team, on September 16. Infrared adjustment of the perimeter placed the acreage at 81,950 on September 21, with the fire in patrol status. Cost to date was \$4,630, 108.

HUNTER FIRE

The Hunter Fire was started on August 20 at approximately 1400 hours as a severe wind storm blew down a green aspen tree over a powerline and pinned it to the ground. This ignited a fire approximately 275 yards northeast of the Aspen Ridge Ranch building, a property of Grand Teton National Park. Suppression action began immediately after discovery. The fire was situated from the point of ignition near the Aspen ridge Ranch north to Antelope Spring, east along Shadow Mountain to southwest of Ditch Creek near Forest Road 30350, south to South Fork of Ditch Creek and Peak 7695. Elevations ranged from 7,000 feet to approximately 8,200 feet.

Special concerns were buildings and developments at Lost Creek Ranch, Triangle X Ranch, the Teton Science School, the Hunter Ranch, Schweiring Ranch, and numerous homes.

Fuels in the area were sagebrush, cured grass, and forbs with an aspen overstory, lodgepole pine, Douglas fir and subalpine fir stands.

Fire Chronology and Management Actions

Initial attack was made at approximately 1415 by a National Park Service engine unit, a slip-on tank, and a water tender under the direction of Denny Ziemann, IC. Secondary attack was made by two Jackson, Teton County Fire Department engines, Teton #1 handcrew, and eight other National Park Service personnel. Pushed by high winds, the fire advanced rapidly onto the Bridger-Teton National Forest. A Type I Team was called by the Chief Ranger, Doug Barnard, at 1500 hours. By 2030, the fire was estimated at 2,000 acres. Mike Schneegas, IC, National Park team, provided continued structure protection throughout the night.

An EFSA was prepared which called for a total control strategy. A Limited Delegation of Authority was made between Grand Teton National Park and Bridger-Teton National Forest, selecting control strategy. the EFSA.

IC Jack Gollaher and the Great Basin Type I Team was assigned to the incident and began arriving at Park Headquarters at 0300 on August 21. The team was briefed by the Superintendent at 0600 on that morning. Temperatures and winds decreased from the previous day, although the relative humidity was as low as 9 percent. Some individual tree crowning occurred, but in general, flame lengths were 2 to 3 feet. Light spotting occurred on the west and north sides of the fire. Objectives for the day were to protect life and property, and to initiate suppression to prevent additional property from threats by the fire, provide information to landowners and residents, and minimize impacts to grizzly bear habitat. Retardant was deployed on the fire. Line was constructed from Ditch Creek to Hunter Ranch, and a dozer line was put in from Schwiering Ranch south towards Antelope Peak. Spot fires on the south flanks were picked up and a

dozer was assigned to pick up a large (5 acres) spot on the north flank in a clearcut area. The fire continued to spread in an easterly and northerly direction due to lack of available resources. Estimated acres burned totaled 3,000 acres. A night shift worked on this fire.

A lower level inversion in Ditch Creek did not break until 1100 on August 21, after which some erratic winds were experienced. Temperatures were in the mid-80's, relative humidity was 10 to 15 percent, and winds reached 7 to 14 miles per hour in the afternoon. Crews and engines were able to continue holding, mopping up on the west side of the fire, but the east flank still received no ground resources. The southwest flank remained active. Air support included tanker drops. Resources were 5 hand crews, 7 engines, and 2 helicopters. Night temperatures dropped to below freezing in the low areas and low 40's on the ridgetops, and relative humidity increased to 50 percent. Conditions were favorable for mop up, but relative humidity was too high for burnout operations. The night shift was able to mop up the more active Division B for 200 feet into the fire except for a few hot spots near the line. A Wyoming National Guard unit consisting of 31 personnel and 13 vehicles arrived to assist in ground operations.

Temperatures increased slightly on August 23, with relative humidity 9 to 15 percent and winds 7 to 14 miles per hour out of the southwest. Active runs were experienced on the east flank once the inversion lifted around 1100. Spotting on the northwest flank of the fire was lined and contained, and mop up continued on the western lines. Acreage was 4,750. A component of the 6th Army arrived from Fort Lewis to begin training prior to line assignments. Resources included 12 crews, 10 engines, 4 dozers, 5 helicopters, 3 airtankers, and 2 light aircraft. Crews placed in Division E on the south and east side of the fire began constructing line from Ditch Creek north towards the crews on the northeast corner of the fire. An excellent job of line construction was done, pushing in 160 chains of new line. Burnout operations went very well. There were only 80 to 100 chains of line open at the end of the night shift. Two National Park Service vehicle accidents occurred this day, one involving a vehicle hitting an elk and another sliding off the road, hitting a tree.

On August 24, there was a heavy inversion, which broke at 1100. Temperatures were 80 to 90 degrees, with relative humidity at 8 to 14 percent and winds southwest at 9 to 15 miles per hour. Some runs were experienced following breakup of the low-level inversion. The upper level inversion broke at about 1430 creating significant convection. The line between Divisions D and E on the east flank had been tied in at 1500. One hour later, the fire made a major run on the east side of the Ditch Creek Road and overran the line. Spotting occurred up to 1/2 mile over the line. By the end of the day shift, 300 acres of the blowout remained unlined. Two airtankers and were available on during this shift. Another National Park Service vehicle accident occurred. The night shift was able to line the blowout in their divisions and a burnout operation went very well. Similar conditions on August 25, lifting of the high level inversion in the late afternoon, again caused blowouts over the line on the east flank due to runs from unburned areas within the lines. Five batteries of 6th Army personnel were assigned to the west divisions and received training and began mop up

as planned. Resources assigned were 25 crews, including 16 Army, 10 engines, 2 airtankers, 5 helicopters, and 1 dozer. Acreage was 5,400 acres. Erratic fire behavior continued during the early hours of the night shift. Winds were 15 to 20 miles per hour and gusty, becoming 4 to 6 miles per hour downslope in the early morning hours. Burnouts continued within the constructed lines and spots from the day shift were picked up.

Winds changed from southwest to westerly during the early hours of August 26, but switched to northerly, increasing to 20 to 30 miles per hour in the late afternoon. The strong winds out of the north caused a run that slopped over the line on the south in the South Fork drainage. Shift crews caught the slopover at 5 acres and began mop up operations by the end of the shift. Williams assumed the IC position on August 26. Infrared flights during the night shift showed all spots to be within the line, with the south and east divisions having significant hot spots near the line. Some 1,717 personnel were assigned to the fire.

On August 27, temperatures increased, relative humidity decreased to 9 to 12 percent, and winds shifted to west and northwest. A heavy inversion dominated the shift. Smoke from this fire, and the Huck-Mink Fires to the north hung in the area and kept fire activity low. The fire was declared 100 percent contained at 5,440 acres with no control date estimated. High evening humidities made burnout operations ineffective. An Army Chinook was utilized to start bringing crews off the fire. Cost at containment is estimated at \$1,484,530.

On August 28, all divisions were in a mop up mode. Army personnel were assigned to portions of the fire with active flame for the first time, and performed well. A flareup over a line was mopped up and discovered to have come out of a dozer berm. Higher temperatures and increased winds caused flare-up and runs within the unburned portions of the interior of the fire. Only military personnel were on the fireline during this shift. A red flag warning for high winds on August 30 did not materialize and there was limited activity in the fire. A shortage of crews hampered mop up. By September 3, 5 new crews were assigned to continue mop up as the fire was still hot and moving within the perimeter. Visibility was very low due to smoke from this and other fires. mop up and rehabilitation continued through September 6 despite high wind warnings. On September 8, 299 personnel were assigned to the fire to continue mop up and rehabilitation. Cost at this date was placed at \$4,230,613. The fire was turned over to the Bridger-Teton National Forest on September 9. Infrared reconnaissance reported shrinking hot spots within the perimeter.

FAYETTE FIRE

The Fayette Fire started by lightning on August 21, 1988, near Fayette Lake on the Pinedale District of the Bridger-Teton National Forest. It reached 38,507 acres by containment on September 11. Elevations on the fire ranged from 8,000 to 10,000 feet. The fuels were predominantly mature to overmature lodgepole pine and subalpine fir, with a large standing dead component. The density of the timber varied from nearly closed canopies to scattered strings of timber on rocky sites.

Fire Chronology and Management Actions

The initial report of the fire was made at 1700 and initial attack was made by 6 smokejumpers at 2022 hours. The terrain was steep, with heavy timber and very dry fuels. Spotting was a problem. By midnight, the fire was 4 acres. It grew to 15 to 20 acres by morning and by 0830, 8 more smokejumpers were on the fire. An additional 14 personnel arrived and 5 air tankers were working to contain the fire. A Type II Team was called for. By evening, the fire had expanded to 200 acres. On August 23, Shive's Type II Team assumed command. Limited access and spotting continued to be problems and the fire made minor runs. Resources totaled 6 crews, 2 dozers, and 129 additional personnel.

The fire continued to grow, with 100 acres spreading into the Bridger Wilderness on August 24. Dozers were not allowed to operate within the wilderness. Some 20 crews, two dozers, and 49 overhead were on the fire. No airtankers were used. Two spike camps were used to get crews closer to the lines. A third was to be established on the north end of the fire. Between 2000 and 2200, a major run overran Spike Camp 2. Equipment was lost, but no injuries were reported. The crews spent the night in a safety zone and were flown out on August 25. Acreage reached 2,650 on August 24.

Major runs from the early morning until late evening were made on August 25, adding 10,000 acres to the fire. Most of the expansion was into the wilderness, but expansion also continued southward threatening a pack station and the resort and subdivision at Boulder Lake. Dozers were utilized on the southwest side of the fire, outside of the wilderness area. Spotting of 1 to 1-1/2 miles was reported. There were 19 crews, 1 helicopter, 5 dozers, and less than 100 overhead on the fire. The strategy was to construct a dozer line along the wet flank to turn the fire's head east into the wilderness to avoid the structures at Boulder Lake.

On August 26, the fire made a major run to the southwest in the direction of Meadow Lake. It also ran eastward from Burnt Lake, above Boulder where it nearly surrounded Lovatt Lake. The fire on the north moved eastward and surrounded Belford Lake. Three airtankers were used to slow the spread towards the Boulder Creek subdivision, until dozer and handline could be constructed. Thirty-five structures were reported threatened and 4 individuals escaped by going through the fire. Spike Camp 2 was abandoned. Fire was estimated at 12,000 acres.

The fire made two minor advances on August 27. Hose equipment was requested, but supply problems limited the amount delivered. Spike Camp 1 and Meadow Spike Camp were demobilized on this date. Five airtankers were used to delay the spread of fire into Boulder Creek drainage. A transition was made from the Type II Team to Bryant's Type I Team and personnel on the fire numbered 556. By the end of the day, acreage was revised downward to 11,300 acres. Again, only minor advances were made by the fire on August 28. Boulder Camp was set up. mop up was delayed due to lack of resources. The fire was 15,045 acres by evening.

By August 29, 65 percent of the fire was in the Bridger Wilderness and access was limited. The decision was made to set up 3 spike camps to facilitate access. No further night shifts were used in order to assure crew safety. Difficult terrain, inability to locate the fire edge due to spotting, and numerous falling, burnt trees made night shifts extremely dangerous. The fire moved very little on August 30, and the Type I Team built up its strength. The Wyoming National Guard sent several crews and helicopters.

The fire made a major run with extremely high, erratic winds on August 31. This pushed the fire to the east, below Lake Christina. Ten and one-half miles of line had been constructed up to this time. The fire was divided into three branches. The complexities of the fire dictated a need for long-range planning. A decision was made to order additional personnel for the planning unit. A run of 2 miles occurred on September 1 to the east. Two spike camps were set up in the Wilderness. Most of the spread was by spotting. The fire expanded to 20,020 acres and was being fought by 910 people. Lack of helicopter support made it difficult to supply and support the crews. Supplying the camps by means of pack animals proved to be slow and inadequate. A stopover in Branch II was contained and work continued on tying lines together.

On September 3, the Wyoming National Guard completed their training on the line. The fire grew slightly east of Lake Jacqueline. There was major concern for fire spread in Pipestone Creek/Boulder Canyon where expansion would cause containment problems in extremely heavy fuel types. The inaccessible rocky terrain made suppression difficult as line construction worked north in the Pipestone drainage. Spotting occurred and was arrested by bucket drops. Late evening torching was observed at the confluence of the North Fork and Pipestone Creek. Though most of the civilian helicopters were reassigned, the Wyoming Air National Guard brought in three helicopters to assist in deploying crews and supplies to Wilderness spike camps.

Crew support and erratic winds still caused major concerns, particularly in the southeast quadrant of the fire. Crews in Branch III worked spot fires from the previous night's flareups on September 4. Good helicopter support suppressed the spots' spread. Support was provided by one military Chinook with a water bucket and a US Forest Service helicopter with bucket and sling capacities. The Forest Service helicopter was reassigned to the Hunter Fire at 1500. Direct line construction attempted between Coyote Lake and Horseshoe Lake was lost due to erratic winds. Three crews were cut off from Horseshoe Camp for several hours. The burnout line was moved to the edge of Lake George due to the advancing fire. The fire grew to 21,400 acres.

By September 5, 43 crews were assigned to the fire and helicopters were scarce. Line was holding and being advanced in all branches. The fire made an initial push to the east due to cold front westerlies. With 2 Wilderness spike camps and several crews utilizing coyote tactics, 5 helicopters were needed to keep them supplied. Nearly all reconnaissance flights were prohibited due to a lack of flight time. Map updates were provided mainly from the air attack lead plane pilot who mapped spot fire concentrations.

On September 6, a burnout between Lake George and Lake Christina held except just north of Mac's Creek, where the fire was pushed by 5 to 15 mile per hour southerly winds. Lines continued to hold except for a few wind-driven slopovers. Helicopter availability continued to be a problem.

Strong winds caused problems on September 7, as a major run occurred at Mac's Creek and spot fires appeared throughout the fire. Horseshoe Camp crews retreated to protect Skinners Camp from a run with numerous spot fires. Boulder Creek slopover doubled in size, but direction of spread was away from private property. During the evening planning session, the decision was made to change tactics from direct to indirect attack with burnouts, thereby running the fire into the rocks below the Continental Divide. Horseshoe Spike Camp was abandoned with its forces transferred to Timico Camp, while Firehole Spike Camp was established.

Burnout began on September 8, with Fall Creek used as a holding line for ground crew and helitorch burning. Prevailing west to southwest winds made the burnout a success as approximately 2.8 miles of burning was completed. Burnout, mop up, and picking up of spots continued to hold and improve lines in Boulder and Pipestone Creeks on September 9. Because of the expected wet and cold weather, plans were made to move all people off the line and relocate base camp to an abandoned school in Pinedale on September 10. mop up continued on September 10 and plans for closure of camps and moving to Pinedale were carried out. An incidental action was taken on a man-caused fire named Big Sandy, 20 miles south of Pinedale Airport, which reached 2 acres in size, using one crew with helicopter assistance.

On September 12, crews returned to the fireline for mop up, rehabilitation, and equipment removal. Spike camps were not reopened due to very cold weather and the possibility of further precipitation. Work on Big Sandy was completed. A lightning holdover 6 miles north of Pinedale Airport was attacked by bucket drops and the District assumed monitoring this additional fire.

Low flight ceilings kept crews out of the fire on September 13, until the low lying cloud cover broke and a crew of 5 could sling equipment out of dismantled spike camps. Crews remained on standby. The fire was turned over to the Forest on September 14. Area involved totaled 38,507 acres and was declared controlled on September 13 at 1800. Cost to date was \$4,893,959.

CORRAL CREEK FIRE

The Corral Creek Fire started to the west of the Lee Metcalf Wilderness in the Beaverhead National Forest on August 29. The cause was a campfire. The fire was located to the east of the Corral Creek and Armitage Ranches; south of Indian Creek and the CB Ranch; west of the South fork of Indian Creek; and Northwest of the Wedge. Elevation ranges from 6,000 to 9,100 feet. The Corral Creek Fire was at 2,860 acres by the time of control on September 6.

Fire Chronology and Management Actions

Although this was a small fire, it was significant in that resources were pulled off other larger fires in the GYA in order to suppress it. At this time, the strategy for the large GYA Fires was confinement/containment, with emphasis on protection of structures and improvements. The transfer of a few resources to Corral Creek did not seriously impact these efforts, and Corral Creek was controlled at minimal acreage with no structures lost.

The Corral Creek Fire was immediately declared a wildfire and it had the potential to become another major fire in the GYA. Clay Gregory's overhead team was called in to manage the fire suppression efforts. By August 31, the fire was threatening ranch and resort structures, and it had grown to 2,600 acres. Resources on the fire at this time included 8 engines, 4 dozers, 4 watertenders and 218 personnel.

On September 1, the fire was declared 65 percent contained. Incident objectives for the day were to provide for personnel and public safety, protect private property and improvements, keep fire south of the main Indian Creek drainage and north of the Wolf Creek drainage. There was a potential need to evacuate the backcountry. Personnel on the fire had increased to 375.

Rapid uphill rates of spread were expected. Crews on Divisions A and B did thorough mop up and cold-trailed along intense burn areas adjacent to unburned fingers and islands. Divisions C and D anchored control lines and removed dead materials adjacent to lines. All divisions patrolled for spot fires.

By September 2, the fire was at 2,820 acres and had burned on both private and National Forest land, including 200 acres of the Lee Metcalf Wilderness. Crews had succeeded in keeping the fire out of Indian Creek. The fire was still posing a threat to ranch and resort structures. Control problems included steep terrain and lack of resources.

The fire was declared 100 percent contained on September 4. If the fire could be kept out of Indian Creek it would be held for sometime by natural barriers. Aggressive mop up, cold-trailing techniques, and anchoring of control lines continued. Resources included 5 engines, 2 dozers, 2 watertenders, 2 helicopters and 385 personnel.

At 1800 on September 6, the Corral Creek Fire was declared controlled at 2,860 acres. Total cost to date was \$713,220.

APPENDIX D-MEDIA CONTACTS

Many Public Information Officers assisted and provided interviews to news media on a repeated and/or continuing basis. Television and radio media included ABC, CBS, CNN, NBC, TV crews from Billings, Denver and Salt Lake City and 200+ radio stations. Newspaper media included AP and UPI reporters, the Atlanta Constitution, the Billings Gazette, the Boston Globe, the Bozeman Chronicle, the Casper Star Tribune, the Chicago Tribune, the Denver Post, the Idaho Post Register, the Jackson Hole News, the Livingston Enterprise, the Los Angeles Times, the Miami Herald Tribune, the New York Times, the Philadelphia Inquirer, the Sacramento Bee, the San Francisco Chronicle, the Washington Post and USA today. Magazine media included Audubon, Insight, National Geographic, Newsweek, People, Science News, Sunset, Time and the Smithsonian.

International media contacts included Australia, Canada, Czechoslovakia, England, France, Germany, and Italy.

